Cranfield University
Silsoe

This thesis is submitted in fulfilment of the requirement for the degree of Doctor of Philosophy

2002

Ruth Mo Wah Yeung

Food Safety Risk: Consumer Food Purchase Models

Supervised by Prof. J. Morris

July 2002

Abstract

Food Safety Risk: Consumer Food Purchase Models

Recent high profile food safety incidents in the United Kingdom have shaken consumer confidence in food products. Consumer perception of risk is seen to be very relevant to food safety issues. The impact of this perceived risk on purchase behaviour is also critical to the development of risk management strategies by authorities responsible for public health and the food industry. Focusing on fresh chicken meat products, this study explored the relationship between food risk characteristics, consumer perception of food safety related risk, consumer purchase behaviour and actions that can be taken to reduce the exposure to food risk.

Following an extensive literature review, an exploratory study in the form of face-to-face interviews was carried out to clarify the main concerns of food hazards, and to identify the items of perceived consequent loss and risk reducing strategies adopted by consumers. The findings were verified through a quantitative survey of 200 respondents. The data was presented in the form of Structural Equation Modelling, and analysed by the LISREL 8.30 statistical package. The results showed that consumer risk perception was affected by a range of risk characteristics, such as consumer concern about the severity of the food risk, and the potential long-term adverse effect on future generation and environment. The main elements of perceived loss associated with food safety were health, financial, time, lifestyle and taste losses, and these were shown to have a negative effect on purchase likelihood. Two other risk characteristics namely, perceived knowledge and own control of the food risk were found to be linked directly and positively to consumer purchase likelihood. Risk reducing strategies such as branded product, product quality assurance and product information adopted by consumers were identified and found to be consistent with the marketing strategies used by the food industry. These risk-reducing strategies have a negative relationship with consumer risk perception.

This study presented empirical evidence for characterising types of food risks and explains how food risks and risk reducing strategies affect consumer risk perception as well as purchase likelihood. Consequently, two quantitative consumer food purchase models were developed. These models can help the government and the food industry to identify key factors to develop systematic strategies for risk management and risk communication in order to allocate resources efficiently and effectively. They can also use these models to measure the effectiveness of their risk management policy in the times of concern about food safety.

This study recommends further research to apply these models in other types of food products and other types of risk, such as chemical risk, and technological risk, in particular for those risks which are beyond the control of consumers. The differences in risk perception between cultures and socio-economic groupings should be explored further. This is a valid topic for further research and provides potential benefits for consumers and food industry as a whole.

ACKNOWLEDGEMENTS

'If any of you lacks wisdom, he should ask God, who gives generously to all without finding fault, and it will be given to him. …. Every good and perfect gift is from above, coming down from the Father of the heavenly lights, who does not change like shifting shadows.' - James 1:5, 17

I thank my Lord, Jesus Christ with my whole heart, without His presence and guidance; this study cannot be accomplished. Glory and Honour be to the Lord, my God.

I am grateful to my supervisor Prof. Joe Morris, for his great insight to the research issue, consistent challenges to the research study and expertise in supervising my PhD project. Many thanks extend to Keith Thompson and Ian Crawford of the Thesis Committee for their incisive comments. Thanks to Simon Medaney of the Language Centre for giving comments on the wording and style of the questionnaire. Thanks also to Charles Neame and Alison Bailey. Thanks to the administration staff in particular Pat Woodland, Anne Radford, Heather Connolly and Linda Chapman for arranging meetings and administrative work. The help from the librarians and the staff of the Computer Help Desk greatly aided the literature search. Special thanks to Dr. Peter Robin as the internal examiner and Dr. Richard Shepherd of University of Surrey as the external examiner.

This work owes a profound intellectual debt to the experts from the academic visits for their invaluable time and useful suggestions. Special thanks to Dr. Lynn Frewer and Susan Miles of Institute of Food Research, Norwich for offering sets of questionnaire in relation to the research study, Dr. Martyn Brown of Unilever

Research, Colworth for commenting the formal questionnaire in order to improve the content validity of the questions, Jane Murray of Avian Science research Centre, Ayr for providing the statistics of poultry meat consumption in the UK, and Prof. Paul Slovic of Decision Research, Oregon and Prof. Catherine Daily of Indiana University, Bloomington for their advice on the issue of using Structural Equation Modelling. Cordially thanks to Peter Bradnock of British Poultry Council and Simon Mead of Meat and Livestock Commission for their invaluable comments on the application of the consumer food purchase model. Thanks also to Alasdair Cook of Veterinary Laboratories Agency, Ida Olsen of the National Farmers' Union and Nina Crump of the Royal Society for the Prevention of Cruelty to Animals for providing information about the assurance quality scheme.

I very much appreciate for the willingness to help and the fascinating opinions of the anonymous 228 respondents that made the data gathering smoothly. Thanks also to the six poultry companies from the industrial survey.

I would like to express my thanks to the friends in Flitwick Baptist Church for their moral and prayer supports. Extra thanks to David and Peggy Patterson, James Diver and Simon Manyiwa for their precious opinion on the research issues.

Finally, I am exceedingly in debt to my beloved husband Wallace Yee for his great contribution including the introduction of Structural Equation Modelling, constant discussions about the research, and continuous encouragement beyond words.

> *'To the only God our Savior be glory, majesty, power and authority, through Jesus Christ our Lord, before all ages, now and forevermore! Amen.' – Jude 25*

TABLE OF CONTENTS

TABLE OF CONTENTS v

LIST OF TABLES xi

LIST OF FIGURES xiii

LIST OF SYMBOLS AND ABBREVIATIONS xv

Chapter

1. Introduction 1

1.1 Background to the Research 1

1.2 Aim and Objectives 4

1.3 Contribution of the Research 4

1.4 Structure of the Research 5

2. Food Safety Risk: Consumer Food Purchase Model 7

2.1 Definitions 7

2.1.1 Hazard 7
2.1.2 Risk 8
2.1.3 Risk Perception 8

2.2 Identification of Food Hazards 10

2.2.1 Microbiological Hazards 11
2.2.1.1 Salmonella 12
2.2.1.2 Campylobacter 13
2.2.1.3 Escherichia Coli 14
2.2.1.4 Listeria Monocytogenes 14
2.2.1.5 Clinical Features of Illnesses Produced by Food Poisoning Bacteria 15
2.2.2 Chemical Hazards 17
2.2.2.1 Pesticide Residues 17
2.2.2.2 Antibiotics and Growth Hormones 18
2.2.2.3 Food Additives 19
2.2.3 Technological Hazards 19
2.2.3.1 Food Irradiation 20
2.2.3.2 Genetic Modification (GM) 21
2.2.4 Nutritional Hazards 23

2.3 Characteristics of Food Risk 24

2.3.1 Psychometric Paradigm 25
2.3.2 Food Risk Characteristic and Risk Perception 33

2.4 Risk Perception 37

2.4.1 Dimension of Risk Perception 37
2.4.2 Measurement of Risk Perception 40
2.4.3 Risk Perception and Purchase Likelihood 41

2.5 Risk Reduction 42
2.5.1 Risk Reducing Strategies *43*
2.5.2 Risk Reduction and Food Safety *44*
2.6 Conceptual Model of Consumer Food Purchase Relating to Food Safety 48
2.7 Summary of the Chapter 50

3. Research Design and Method 53

3.1 Procedural Flow Diagram of the Research 53
3.2 Research Framework 54
3.3 Hypotheses Revisited 55
3.4 Research Approach 56
3.5 Qualitative Study 57
3.5.1 Study Design *57*
3.5.2 Data Collection *58*
3.5.3 Data Analysis *59*
3.5.4 Limitation of Qualitative Study *60*
3.6 Quantitative Study 61
3.5.1 Sampling Design *61*
3.5.2 Quota Size *62*
3.5.3 Instrument Development *63*
3.5.4 Data Collection *67*
3.5.5 Data Purification Using Principal Components Analysis *68*
3.5.6 Justification of Structural Equation Modelling *69*
3.5.7 Data Analysis Using Structural Equation Modelling *71*
3.6.7.1 Procedural Flow Diagram of SEM 73
3.5.7.2 Model Specification and Identification in SEM 74
3.5.7.3 Path Diagram Construction 74
3.5.7.4 Parameter Estimation 74
3.5.7.5 Measurement Submodel Evaluation 75
3.5.7.6 Structural Submodel Evaluation 76
3.5.7.7 Overall Model Fit Evaluation 76
3.6.7.8 Power Test of Close Fit 78
3.6.7.9 Comparing Rival Model 78
3.6.7.10 Model Improvement 79
3.6.7.11 Hypotheses Testing 79
3.7 Study Appraisal 79
3.7.1 Academic Visits *79*
3.7.2 Conferences *80*
3.7.3 Industrial Consultation *80*
3.8 Critique of the Approach 81
3.9 Summary of the Chapter 83

4. Qualitative Study of Consumer Main Concern 84

4.1 Results and Discussion 84
4.1.1 The Main Food Risk in Chicken Meat *84*
4.1.2 Perceived Consequent Losses Associated with Food Safety Risk in Chicken Meat *87*

4.1.3 Risk Reduction Adopted in Chicken Purchase Associated with Food Safety ... 91
4.1.3.1 Product Quality ... 91
4.1.3.2 Product Information ... 92
4.1.3.3 Product Price ... 94
4.1.3.4 Place of Purchase ... 95
4.1.3.5 Post-Purchase Control ... 96
4.2 Summary of the Chapter ... 98

5. Food Risk Characteristics: Consumer Food Purchase Model ... 101

5.1 Characteristics of Respondents ... 101
5.2 Test of Personal Characteristics on Future Purchase Likelihood ... 102
5.3 Descriptive Statistics ... 103
5.4 Data Purification Using Principal Components Analysis ... 104
5.5 Initial Proposed Model (Model A) ... 107
5.5.1 Path Diagram of Model A ... 113
5.5.2 Evaluation of Model A ... 113
5.5.2.1 Reliability of Measurement Submodel ... 113
5.5.1.2 Validity of Measurement Submodel ... 117
5.5.1.3 Assessment of Structural Submodel ... 118
5.5.3 Overall Model Fit of Model A ... 118
5.6 Rival Model (Model B) ... 119
5.6.1 Path Diagram of Model B ... 124
5.6.2 Evaluation of Model B ... 124
5.6.3 Overall Model Fit of Model B ... 124
5.6.4 Comparison of Model A with Model B ... 125
5.7 Improvement to Model B ... 127
5.7.1 Comparison of Model B_1 with Model B ... 129
5.8 Hypothesis testing ... 130
5.9 Discussion ... 133
5.9.1 Risk Characteristics and Risk Perception ... 133
5.9.1.1 Concern and Risk Perception ... 133
5.9.1.2 Adverse Effect and Risk Perception ... 134
5.9.1.3 Involuntary and Risk Perception ... 134
5.9.1.4 Activist Influence and Risk Perception ... 135
5.9.1.5 Uncontrollable and Risk Perception ... 135
5.9.1.6 Legislation and Risk Perception ... 136
5.9.2 Risk Characteristics and Purchase Likelihood ... 136
5.9.2.1 Knowledge and Purchase Likelihood ... 136
5.9.2.2 Own Control and Purchase Likelihood ... 137
5.9.3 Risk Perception and Purchase Likelihood ... 138
5.10 Summary of the Chapter ... 138

6. Risk Reduction: Consumer Food Purchase Model ... 141

6.1 Descriptive Statistics ... 141
6.2 Data Purification Using Principal Components Analysis ... 142
6.3 Proposed Model (Model C) ... 144

6.3.1 Path Diagram of Model C *150*
6.3.2 Evaluation of Model C *150*
6.3.2.1 Reliability of Measurement Submodel 150
6.3.2.2 Validity of Measurement Submodel 153
6.3.2.3 Assessment of Structural Submodel 154
6.3.3 Overall Model Fit of Model C *155*
6.4 Rival Model (Model D) 156
6.4.1 Path Diagram of Model D *159*
6.4.2 Evaluation of the Rival Model *159*
6.4.3 Overall Model Fit of Model D *160*
6.4.4 Comparison of Model C with Model D *161*
6.5 Improvement to Model C 162
6.5.1 Comparison of the Proposed Model with the Modified Models *165*
6.6 Hypothesis testing 167
6.7 Discussion 169
6.7.1 Risk Reducing Strategies and Risk Perception *169*
6.7.1.1 Brand and Risk Perception 169
6.7.1.2 Information and Risk Perception 170
6.7.1.3 Quality Assurance and Risk Perception 171
6.7.1.4 Post-Purchase Control and Risk Perception 172
6.7.1.5 Price Discount and Risk Perception 172
6.7.2 Risk Perception and Purchase Likelihood *173*
6.8 Summary of the Chapter 174

7. Conclusions, Implications, Contribution, Limitation and Recommendations 176

7.1 Summary of Study of Consumer Risk Perception 176
7.2 Summary of Consumer Surveys 178
7.2.1 Food Hazards in Chicken Meat *178*
7.2.2 Food Risk Characteristics *178*
7.2.3 Perceived Risk Theory *180*
7.2.4 Risk Reducing Strategies *180*
7.2.5 Purchase Likelihood *181*
7.2.6 Consumer Food Purchase Models *181*
7.3 Industrial Consultation 182
7.3.1 Importance of Consumer Perceived Risk to Poultry Industry *183*
7.3.2 Influential Factors to Consumer Risk Perception *183*
7.3.2.1 Media Attention 183
7.3.2.2 Incident History 184
7.3.2.3 Intensive Production 184
7.3.2.4 Self-confidence 184
7.3.3 Risk Reducing Strategies Adopted by Consumers *184*
7.3.3.1 Reduction in Purchase 185
7.3.3.2 Branded Product 185
7.3.3.3 Kitchen Hygiene 185
7.3.4 Methods to Reduce Perceived Risk and Restore Consumer Confidence *186*
7.4 Implications for the Government and Food Industry 187
7.5 Contributions of the Study 190
7.6 Limitation of the Study 191

7.7 Recommendations for Future Research 193

7.7.1 Research Refinement *193*
7.7.2 Research Extension... *194*
7.7.3 Other Academic and Industrial Research.. *195*

7.8 Closing Statement..197

References…………………………………………………………………………198

Appendices……………………………………………………………………..…..222

Appendix 1 Criteria for Data Screening Prior to Using Principal Component Analysis (PCA) 222
Appendix 2 Correlation Matrix for Risk Characteristics 223
Appendix 3 Assumptions of Using Structural Equation Modelling (SEM)............225
Appendix 4 Measurement Submodel 226
Appendix 5 Structural Submodel...227
Appendix 6 Path Diagram in SEM...228
Appendix 7 Mathematical Equations of Path Diagram..231
Appendix 8 Reliability of Measurement Submodel..232
Appendix 9 Validity of Measurement Submodel 233
Appendix 10 Validity of Structural Submodel 235
Appendix 11 Indices for Absolute Fit 236
Appendix 12 Indices for Comparative Fit 238
Appendix 13 Indices for Parsimonious Fit...239
Appendix 14 Power Estimates of Close Fit..240
Appendix 15 Record of Conducting Quantitative Survey.......................................241
Appendix 16 Descriptive Statistics of Measurement Items.....................................242
Appendix 17 Kaiser's Criterion - Total Variance Explained for Risk Characteristics 245
Appendix 18 Number of Factors for Risk Characteristics Based on Scree Test 246
Appendix 19 Correlation Matrix of Measurement Items for Risk Characteristics....249
Appendix 20 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Characteristics 251
Appendix 21 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Characteristics 255
Appendix 22 Assessment of Discriminant Validity of Measurement Submodel – Risk Characteristics 260
Appendix 23 Assessment of Factor Validity – Risk Characteristics 263
Appendix 24 Model Specification for Consumer Food Purchase Rival Model Linking with Risk Characteristics 264
Appendix 25 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Characteristics 268
Appendix 26 Modification Index for Consumer Food Purchase Model Linking with Risk Characteristics 272

Appendix 27 Standardised Residuals for Consumer Food Purchase Model Linking with Risk Characteristics 273
Appendix 28 Model Specification for Consumer Food Purchase Modified Model Linking with Risk Characteristics 275
Appendix 29 Parameter Estimates for Consumer Food Purchase Modified Model Linking with Risk Characteristics 279
Appendix 30 Correlation Matrix for Risk Reduction....................283
Appendix 31 Total Variance Explained for Risk Reduction 285
Appendix 32 Correlation Matrix of Measurement Items for Risk Reduction 286
Appendix 33 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Reduction 288
Appendix 34 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Reduction 291
Appendix 35 Assessment of Discriminant Validity of Measurement Submodel 295
Appendix 36 Assessment of Factor Validity 296
Appendix 37 Model Specification for Consumer Food Purchase Rival Model Linking with Risk Reduction 297
Appendix 38 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Reduction 300
Appendix 39 Modification Index for Consumer Food Purchase Model Linking with Risk Reduction 304
Appendix 40 Standardised Residuals for Consumer Food Purchase Model Linking with Risk Reduction 305
Appendix 41 Model Specification of Model M1 for Consumer Food Purchase Linking with Risk Reduction 307
Appendix 42 Parameter Estimates of Model M1 for Consumer Food Purchase Linking with Risk Reduction 310
Appendix 43 Model Specification of Model M2 for Consumer Food Purchase Linking with Risk Reduction 314
Appendix 44 Parameter Estimates of Model M2 for Consumer Food Purchase Linking with Risk Reduction 317
Appendix 45 Model Specification of Model M3 for Consumer Food Purchase Linking with Risk Reduction 321
Appendix 46 Parameter Estimates of Model M3 for Consumer Food Purchase Linking with Risk Reduction 324
Appendix 47 Sample of Questionnaire....................328
Appendix 48 Samples of Qualitative Interview Records 333

LIST OF TABLES

Chapter 2. Food Safety Risk: Consumer Food Purchase Model

Table 2.1 Illnesses Produced by Food Poisoning Bacteria..16

Table 2.2 Components of Perceived Risk Associated with Food Safety 39

Table 2.3 Risk Reducing Strategies Associated with Food Safety 47

Chapter 3. Research Design and Method

Table 3.1 Measurement Items for Food Risk Characteristics....................................64

Table 3.2 Measurement Items for Perceived Consequent Loss..................................65

Table 3.3 Measurement Items for Purchase Likelihood..66

Table 3.4 Measurement Items for Risk Reduction..66

Table 3.5 Guidelines of Overall Model Fit..77

Chapter 4. Qualitative Study of Consumer Main Concern

Table 4.1 Sources of Perceived Main Food Risk in Chicken Meat 86

Table 4.2 Types of Consequent Loss Associated with Food Safety Risk in Chicken .90

Table 4.3 Type of Risk Reducing Strategies Associated with Food Safety in Chicken 98

Chapter 5. Food Risk Characteristic: Consumer Food Purchase Model

Table 5.1 Characteristics of Respondents...102

Table 5.2 Test of Personal Characteristics on Purchase Likelihood.........................103

Table 5.3 Rotated Factor Matrix for Risk Characteristics.......................................106

Table 5.4 Factors of the Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics 110

Table 5.5 Factors with Item Loadings – Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics..114

Table 5.6 Reliability of the Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics 116

Table 5.7 Overall Model Fit of the Proposed Model (Model A) for Consumer Food Purchase Relating to Risk Characteristics 119

Table 5.8 Factors with Item Loadings – Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics 121
Table 5.9 Overall Model Fit of the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics 125
Table 5.10 Comparison of the Proposed Model (Model A) and the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics 126
Table 5.11 Comparison of the Modified Model (Model B_1) and the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics 129
Table 5.12 Effects of Food Risk Characteristics to Risk Perception and Purchase Likelihood (Based on Model B)..132

Chapter 6. Risk Reduction: Consumer Food Purchase Model

Table 6.1 Rotated Factor Matrix for Risk Reduction..143
Table 6.2 Factors of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction 147
Table 6.3 Factors with Item Loadings - Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction 151
Table 6.4 Reliability of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction 153
Table 6.5 Overall Model Fit of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction 155
Table 6.6 Factors with Item Loadings – Rival Model (Model D) for Risk Reduction in Consumer Food Purchase..157
Table 6.7 Overall Model Fit of the Rival Model (Model D) for Risk Reduction in Consumer Food Purchase..161
Table 6.8 Comparison of the Proposed Model (Model C) and the Rival Model (Model D) for Risk Reduction in Consumer Food Purchase 162
Table 6.9 Comparison of the Proposed Model (Model C) and the Modified Models (Models C_1, C_2, and C_3) for Risk Reduction in Consumer Food Purchase 166
Table 6.10 Effects of Risk Reductions to Risk Perception and Purchase Likelihood (Based on Model C)...168

LIST OF FIGURES

Chapter 1. Introduction

Figure 1.1 Structure Of The Research 5

Chapter 2. Food Safety Risk: Consumer Food Purchase Model

Figure 2.1 Notifications Of Food Poisoning And Laboratory Report In The UK 12
Figure 2.2 Factor Structure Of Perceived Risk 26
Figure 2.3 Location Of Food-Related Hazards Within The Two-Component Dimensions 28
Figure 2.4 Location Of Chemical Hazards Within The Two-Component Dimensions 30
Figure 2.5 Location Of Risk Associated With Technology Within The Two-Component Dimensions 32
Figure 2.6 Changes Of Eating Habit In Relation Of Concern About Food Risks 41
Figure 2.7 Conceptual Consumer Food Purchase Model Relating To Food Safety ...50

Chapter 3. Research Design and Method

Figure 3.1 Procedural Flow Diagram For Research Design 54
Figure 3.2 Consumer Food Purchase Model Linking With Food Risk Characteristic 72
Figure 3.3 Consumer Food Purchase Model Linking With Risk Reduction 72
Figure 3.4 Procedural Flow Diagram Of SEM 73

Chapter 5. Food Risk Characteristic: Consumer Food Purchase Model

Figure 5.1 Path Diagram Of The Proposed Consumer Food Purchase Model (Model A) Relating To Risk Characteristics 112
Figure 5.2 Path Diagram Of The Rival Model (Model B) For Consumer Food Purchase Relating To Risk Characteristics 123
Figure 5.3 Path Diagram Of The Modified Model (Model B1) For Consumer Food Purchase Relating To Risk Characteristics 128

Figure 5.4 Path Diagram Of The Adopted Model (Model B) For Consumer Food Purchase Relating To Risk Characteristics 131

Chapter 6. Risk Reduction: Consumer Food Purchase Model

Figure 6.1 Path Diagram Of The Proposed Consumer Food Purchase Model (Model C) Relating To Risk Reduction 149

Figure 6.2 Path Diagram Of The Rival Model (Model D) For Risk Reduction In Consumer Food Purchase..160

Figure 6.3 Path Diagram Of The Modified Model C1 For Risk Reduction In Consumer Food Purchase..163

Figure 6.4 Path Diagram Of The Modified Model C2 For Risk Reduction In Consumer Food Purchase..164

Figure 6.5 Path Diagram Of The Modified Model C3 For Risk Reduction In Consumer Food Purchase..165

Figure 6.6 Path Diagram Of The Adopted Model (Model C) For Risk Reduction In Consumer Food Purchase..167

LIST OF SYMBOLS AND ABBREVITIONS

β	BETA	Regression coefficient among η
B	BETA (BE)	Matrix of regression coefficients among η
δ	DELTA	Error for x
ε	EPSILON	Error for y
η	ETA	Exogenous latent variables
Γ	GAMMA (GA)	Matrix of regression coefficients between η and ξ
ξ	KSI	Endogenous latent variables
λ^x	LAMBDA-X (LX)	Factor loading between x and ξ
λ^y	LAMBDA-Y (LY)	Factor loading between y and η
Φ	PHI (PH)	Variance-covariance matrix of ξ
Ψ	PSI (PS)	Variance-covariance matrix of ζ
ζ	ZETA	Structural error
Θ_δ	THETA DELTA (TD)	Variance-covariance matrix among measurement errors of x
Θ_ε	THETA EPSILON (TE)	variance-covariance matrix among measurement errors of y
$\Theta_{\delta,\varepsilon}$	THETA (TH)	variance-covariance matrix among measurement errors of x and y
Λ_x	LAMBDA-X (LX)	Vector of factor loading between x and ξ
Λ_y	LAMBDA-Y (LY)	vector of factor loading between y and η
ACP		Assured chicken product
AGFI		Adjusted goodness of fit index
BPC		British Poultry Council
BSE		Bovine Spongiform Encephalopathy
CFI		Comparative fit index
DEFRA		Department of Environment, Food and Rural Affairs
d.f.		Degree of freedom
E. Coli		Escherichia Coli

ECVI	Expected cross-validation index
FDA	The Department of Health and Human Service's Food and Drug Administration
FSA	The Food Standards Agency
GFI	Goodness of fit index
GM	Genetic modification
GMO	Genetically modified organisms
IFI	Incremental fit index
KMO	Kaiser-Mayer-Olkin Measure of Sampling Adequacy
MAFF	Ministry of Agriculture, Fisheries and Food
MBM	Meat and bone meal
MGA	Melengestrol acetate
m.i.	Modification index
NFI	Normed fit index
NNFI	Non-normed fit index
nvCJD	New variant Crentzfeldt-Jakob Disease
PCA	Principal Component Analysis
PGFI	Parsimonious goodness of fit index
PHLS	Public Health Laboratory Service
PNFI	Parsimonious normed fit index
RFI	Relative fit index
RMSEA	Root-mean-square error of approximation
SCVPH	The Scientific Committee on Veterinary Measures Relating to Public Health
S.D.	Standard deviation
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Sciences
TLI	Tucker-Lewis index
UK	United Kingdom
WLS	General Weighted Least Squares method
x	Observed independent variable
y	Observed dependent variable

CHAPTER ONE

1. INTRODUCTION

This chapter includes the background to the research, aim and objectives of the present study. The structure of the research and the outline of this thesis are presented at the end of the chapter.

1.1 Background to the Research

Food safety has become a major issue of pubic concern in Britain, as bacterial outbreaks, *bovine spongiform encephalopathy (BSE)*, and alleged risks associated with genetically modified organisms (GMOs) in food have reduced consumer confidence in the healthiness of food products (Birchard, 1999). Restoring confidence in food now presents a considerable commercial challenge to the food industry (Jardine, 1999). It is also of considerable political significance, evident in the recent establishment of the Food Standards Agency for England and Wales (Pring, 1997; Hart, 1997; Green, 1998). Its remit includes aspects of re-assuring public faith in food and providing adequate information to consumers in making an informed food choice (Beecham, 2000).

Inevitably, the recent food 'scares' have impact on consumer purchase behaviour (Mintel, 1997; Hume, 2001). For instance, the collapse of beef market in the UK, France and Germany following the *BSE* crisis has been clearly seen. Though the UK beef market has gradually recovered, a huge loss in export and a fall in the value of domestic sales was recorded (Palmer, 1996). This is in line with the theory of perceived risk. Consumer purchase behaviour is particularly shaped by the subjective impressions of these highly publicized events (Bauer, 1967). Likewise, consumer food choice is often influenced more by the psychological interpretation of product properties than the physical properties of products themselves (Rozin, Pelchat and Fallon, 1986). Perception of food safety risk is one such psychological interpretation that influences the attitudes and behaviour of consumers with respect to the purchase and consumption of food products.

In this regard, perception of food safety risk has important consequences for both consumer and producer welfare, and the overall effectiveness and efficiency of the food supply chain. This is especially the case where there is considerable divergence between what might be called objective, technical assessments of risk and subjective, psychological assessments of risk. Such divergence may arise because of inadequacy of risk communication systems and/or a loss of confidence or trust in the food supply chain and its various agents, including regulators. In many respects, this divergence and its consequences have been evident in the UK *BSE* crisis with respect to expressions of public concerns and management responses by industry and Government (MAFF, 2000).

Extensive research has been conducted to assess public risk perception on various potential food-related hazards, chemical in foods, biotechnological food production and so forth (Huang, 1993; Eom, 1994; Sparks and Shepherd, 1994a; Grobe and Douthitt, 1995; Douthitt, 1995; Chipman, Kendall, Auld, Slater and Keefe, 1995; Frewer, Howard and Shepherd, 1995a and 1995b; Shepherd, 1996; Wohl, 1998). A link between a food hazard and consumer risk perception has been identified through these studies. Likewise, a link between consumer risk perception and purchase behaviour has also been confirmed by the perceived risk theory in the context of consumer purchase behaviour (e.g. Bauer, 1967; Roselius, 1971; Mitchell and Greatorex, 1988; Tse, 1999). A linkage among food hazard, risk perception and purchase behaviour however, remains unexplored at present. The linkage is seen to be very relevant to food safety issue.

Taking chicken meat as an example, poultry meat is a favourite food product, now accounting for 40 percent of all meat eaten in the UK (MAFF Statistics, 2000a and

2000b). A recent test conducted by Consumer Association of 316 samples of chicken products with five supermarkets however shows that *Salmonella* or *Campylobacter* were found in 16 percent of overall chickens being tested (Which?, 2001a). There has also been some, hitherto unsubstantiated, claims of the risk of cross species transfer of BSE (MAFF, 2000; Langdon, 2000). Peter Stevenson of Compassion in World Farming is convinced that broiler chicken may be a major food scare waiting to happen after the *BSE* crisis (Guardian, 1999a). This is due to the excessive use of antibiotics on farms, both for medicinal and growth purposes (Gottlieb, 2000). Contaminated feed caused the level of dioxin to exceed the approved level in Belgian chicken (FSA, 1999). The high dioxin level may cause cancer in human (Economist, 1999). In addition, the low hygiene condition of the slaughtering process in the UK adds to public concern (Meikle 2000). Alternately, these food scares increase consumer perception of food safety risk.

The occurrence of food contamination and disease in food has become so common and so public. It may also be due to food producers constantly adopting new technologies that affect many people when a risk arises in the application of technology (Hargreaves, 1999). A study in exploring public attitude to food safety has shown that the main scares that come to people's minds are *BSE*, *Salmonella* and genetically modified foods (FSA, 2000a). This was also the case in a survey by Henson and Northen (2000) which showed that respondents are greatly concerned about *BSE*, *Salmonella*, antibiotics and hormones. A further survey showed that 54% of consumers are concerned about the hygiene standard in raw chicken, the highest among all raw meats (FSA, 2001a). A recent survey of meat and poultry packers scored them poorly in performance, such as hygiene standards (Silver, 2001). The conditions in which poultry are raised and the feed given to livestock also worry the consumers (Tietjen and Fung, 1995).

The research reported here is carried out to build up a framework to analyse risk induced purchaser behaviour. It focuses on chicken meat, for which consumer confidence has at times been shaken by concern over contaminated feed and intensive production and processing methods (Bates, 1999; Meikle, 1999a).

1.2 Aim and Objectives

This study explores the link between the characteristics of food safety related risk, consumer risk perception and purchase behaviour in order to build a consumer food purchase model. Correspondingly, strategies adopted by consumers to reduce exposure to perceived risk are also examined.

The above aim is achieved by the following objectives:

- To identify the characteristics of food risk influencing consumer risk perception.
- To determine the impact of consumer risk perception on purchase likelihood.
- To identify the methods of risk reductions used by consumers to reduce perceived food risk.

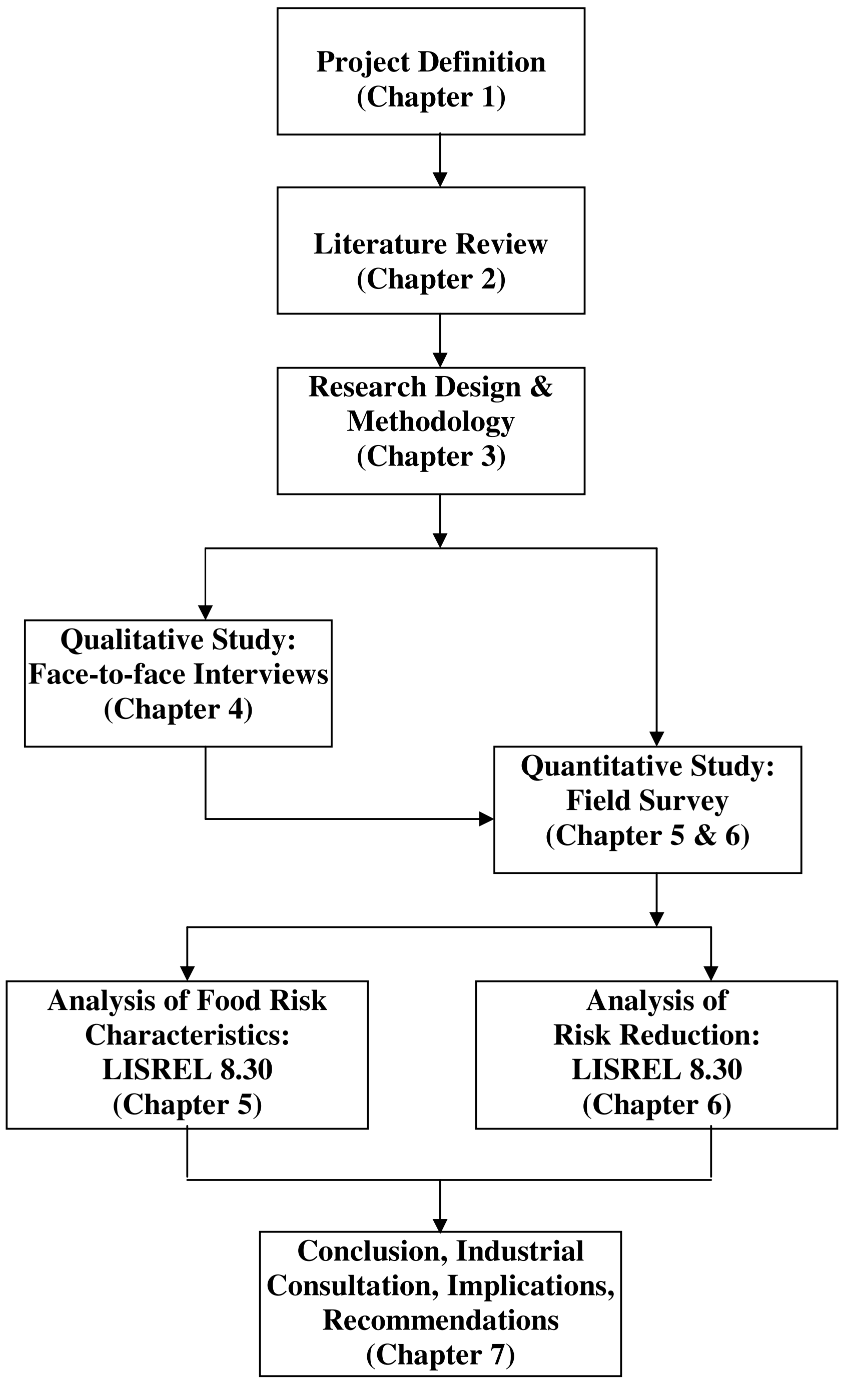
1.3 Contribution of the Research

This research presents empirical evidence of the importance of perceived risk theory in relation to food safety. Consumer food purchase models are developed to link up food risk and purchase likelihood by means of identifying food risk characteristics or risk reducing strategies influencing consumer risk perception and the subsequent impact on purchase likelihood. This provides a framework by merging the work of Slovic and Bauer’s perceived risk theory for characterising and understanding how the type of food risks affecting consumer food purchase likelihood. The findings are critical to the development of risk management strategies to be adopted by those authorities charged with protecting public health, and by the food industry itself. Indeed, the analysis of consumer perceived risk could help to formulate effective risk communication and management programmes, and to guide allocating resources accordingly.

1.4 Structure of the Research

The structure of the research follows the flow as described in Figure 1.1.

Figure 1.1 Structure of the Research



This thesis is divided into seven chapters. This chapter provides an introduction including the background to the research, aim and objectives, and contribution of the study. Chapter 2 starts with definitions of the research issue and identification of food hazards in this context. Characteristics of food risk and their relationship with consumer risk perception and the impact of the latter on purchase likelihood, as well as the strategies of risk reduction adopted by consumers, are also reviewed and discussed. Chapter 3 describes the research design and methodology adopted by the study. Chapter 4 illustrates and discusses the results of an exploratory study of consumer risk perception and risk reduction relating to the safety of chicken meat. The findings help to develop the questionnaire of the quantitative survey. Chapter 5 contains the result and analysis of the quantitative study related to the linkage between food risk characteristics and purchase likelihood. The analysis and result of the linkage between risk reduction and purchase likelihood are discussed in Chapter 6. Chapter 7 covers the conclusion and implications for the food industry, together with the recommendations for the future research emerging from the study.

CHAPTER TWO

2. FOOD SAFETY RISK: CONSUMER FOOD PURCHASE MODEL

This chapter defines the research issues and the scope of the study, followed by an identification of food hazard in chicken meat products. The consequences of individual food hazards and public perception towards these hazards are discussed and examined. The characteristics of food risk, consumer risk perception (also known as perceived risk) and risk reduction are reviewed and identified. The links between each of them are determined and discussed. Three hypotheses are derived and presented. A summary is included at the end of the chapter.

2.1 Definitions

2.1.1 Hazard

The National Research Council (1989) defines hazard in general, *"as an act or phenomenon posing potential harm to some person(s) or thing(s)."* It further suggests that "*the magnitude of the hazard is the amount of harm that might result, including the seriousness and the number of people exposed."* In other words, a hazard can be explained as an event or occurrence associated with an activity or process, which can result in negative consequences and thereby provide a source of risk to a receiving environment or population. Hellesoy, Gronhaug and Kvitasteinargue (1998) argue that hazard would be outside the control of the individual and outside his/her decision making or choice context.

In relation to food safety, Sanders (1999) defines that a food hazard is "*biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect.*" He extends the definition by including different aspects of harm from food, such as food poisoning.

2.1.2 Risk

By adding the probability to the hazard and its magnitude, the National Research Council (1989) cites that "the concept of risk further quantifies hazards by attaching the probability of being realised to each level of potential harm".

In the context of potentially harmful situations, risk is technically defined as *"a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence"* (Royal Society, 1992).

With respect to food hazard, the European Commission (1997) defines risk associated with microbiological hazards in food as *"a function of the probability of an adverse health effect and the severity of that effect, consequential to a hazard(s) in food."*

Regarding statistical treatment, an expected average value of risk is based on the sum of the products of possible outcomes and their respective relative probabilities. Thus, for situations with serious but highly unlikely hazards, a low 'technical' risk is obtained if the magnitude of the hazard is multiplied by the very low probability. This is the kind of risk assessment often engaged in environmental and safety management, such as the review of risk associated with the disposal of carcasses potentially contaminated with *BSE* (DNV Technica, 1997)

2.1.3 Risk Perception

Critics of the technical approach to risk definition are quick to point out that it is inadequate for two main reasons. First, for many situations hazardous to public and environmental health, the identities and relative probabilities of outcomes are not fully known, and therefore by definition the context is one of 'uncertainty' rather than 'risk' (Rayner and Cantor, 1987). Decision rules for uncertain situations, such as minimising regret or satisfying some minimum requirement, are very different from those used in risky situations where outcomes and probabilities are to a large extent reasonably well-defined (Wilkes 1989; Goodwin and Wright 1997). Second, individuals and groups exposed to the hazard tend to focus on the severity of possible consequences more than the probability of occurrence when they assess the significance of exposure to risk or uncertainty. This is especially the case when outcomes are particularly 'uncertain'. It is this divergence of perspective that is at the root of the difference between technical and social definitions of risk, and the reason why technical assessment of risk has proved an inadequate basis for the management of social risk (Shrader-Frechette, 1990), including food safety issues.

Over past decades, scholars define perceived risk as follows:

Cox (1967a) proposes that *"perceived risk is a function of uncertainty and consequences, presumably reduction of the amount of perceived risk can be achieved by increasing certainty and / or reducing the consequences."*

Cunningham (1967a) conceptualise perceived risk in terms of these two components, uncertainty and consequences, that is the perceived certainty of a given event happening and the consequences involved if the event should happen.

Bettman (1973a) defines perceived risk as *"an individual's assessment of how risky a situation is in terms of probabilistic estimates of the degree of situational uncertainty, how controllable that uncertainty is, and confidence in those estimates"*.

Slovic (1987) observes that *"the majority of citizens rely on intuitive risk judgements"* and further explains, *"for these people, experience with hazards tends to come from the news media that rather thoroughly document mishaps and threats occurring throughout the world."*

Sparks and Shepherd (1994b) cite that perceived risk is *"the combined evaluation that is made by an individual of the likelihood of an adverse event occurring in the future and its likely consequences"*

To conclude the definitions, perceived risk is based more on individual subjective judgement of the risk than objective risk assessment. People very often judge risk as a combination of uncertain outcomes and severity consequence. Consumer purchase behaviour would be more likely affected by their subjective judgement, that is, the perceived risk, because of the uncertain hazardous consequence of food risk. As Bauer (1967) argues, "consumer behaviour involves risk in the sense that any action of a consumer will produce consequences which he cannot anticipate with anything approximating certainty and some of which at least are likely to be unpleasant".

Perceived risk is then defined as:

> *"Individual judgement of the likelihood that a consequent loss could occur and the seriousness of its likely consequences."*

2.2 Identification of Food Hazards

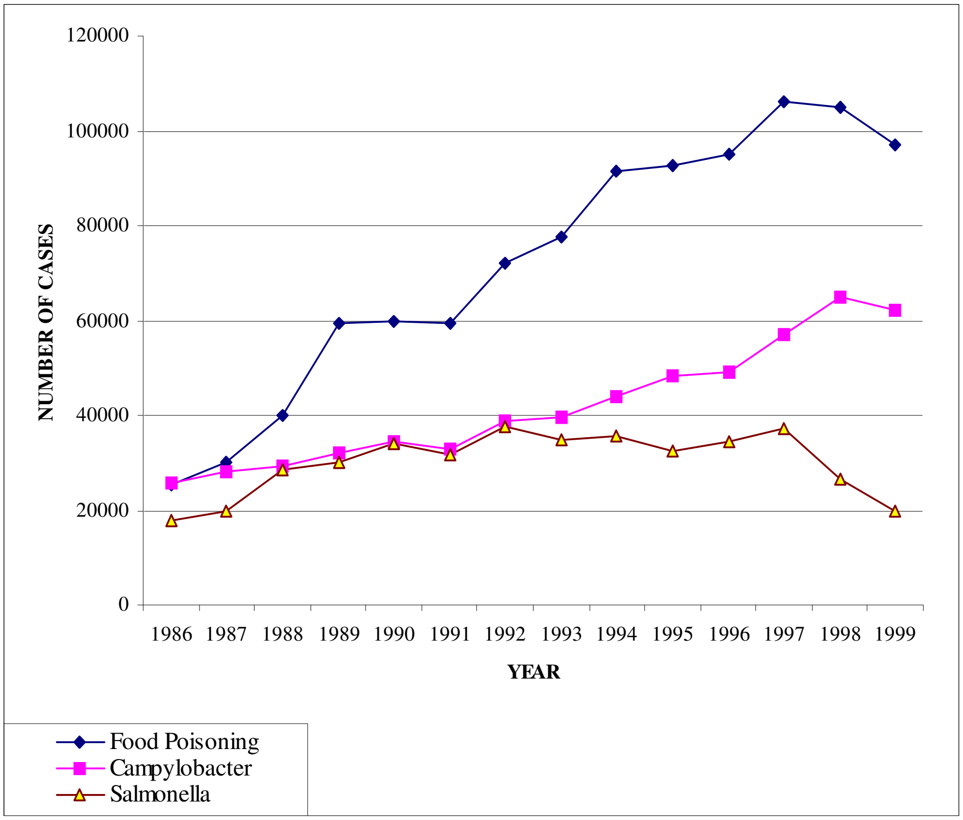
The analysis of risk relating to food safety can begin with the identification of food hazards. The process is to identify the biological agent capable of causing adverse health effects that presented in a particular food (Cahill, 2000). Nevertheless, some types of hazards are acute, shortly after the consumption of food, such as food poisoning. Some may not be easily detected, such as *BSE*. Both types are recognized to be of great importance to public health. Hazards associated with the consumption of chicken meat are then classified into microbiological, chemical, technological and nutritional hazards in this study. A view of public concern is also discussed accordingly.

2.2.1 Microbiological Hazards

Microbiological hazards refer to all hazards caused by bacteria. These are living microorganisms that can cause food spoilage and possibly food poisoning for consumers. These can be harmful to health directly or indirectly. Bacteria are the greatest threat to food safety (IASTATE, 2001). The cumulative totals for reported incidences of food poisoning in the UK rose from 70,130 cases in 1993 to over 83,618 in 1999 (CDR, 1996 and 2001). The vast majority of reported food poisoning cases within the UK are bacterial. The common food poisoning bacteria are *Salmonella*, *Campylobacter Coli, Escherichia Coli* and *Listeria monocytogenes* (*E. Coli*) (FSAC 1993). A survey with more than 500 British medical professionals conducted by Public Health Laboratory Service (PHLS) listed that *Salmonellosis*, *Campylobacteriosis and E. Coli* were among the top 10 major diseases threatening public health (Horby, Rushby, Graham and O'Mahony, 1999).

Salmonellosis and *Campylobacteriosis* are perhaps the commonest foodborne diseases. They are commonly found in chicken (Suzuki, 1994; Tietjen and Fung, 1995; IFST, 1995a; IFST, 1997; Which? 2001a). Outbreaks of food poisoning associated with *Salmonella* are largely related to consumption of contaminated poultry or eggs (WHO, 1996; IAH, 2000). There were 19,801 cases of *Salmonella* and 61,713 cases of *Campylobacter* reported from laboratories in the UK in 1999, which cause approximately one-fifth and over half of all reported food poisoning cases respectively. Notifications of food poisoning and laboratory reports of *Salmonella* and *Campylobacter* are shown in Figure 2.1 (FSA, 2000b). The number of reported cases of *Salmonella* has dropped to 1986 level due to the progress in the control of *Salmonella* over the last few years (FSA, 2000b). General concern about food contamination by *Salmonella* and *Campylobacter* still outweighs contamination with other pathogenic disease (PHLS, 1998; Nagy and Mulder, 2000).

Figure 2.1 Notifications of Food Poisoning and Laboratory Report in the UK



(Source: FSA, 2000b)

2.2.1.1 Salmonella

Salmonella is commonly found in raw meat (FSAC, 1993). The majority of chickens and many other farm animals carrying *Salmonella* in their intestines may be due to the contaminated animal feed (Muhlenberg, 1992; Stark, 2000). Intensive poultry production is suspected to cause the spread of *Salmonella* (Johnston, 2000). The contamination of meat is further extended subsequently by the bacteria through the surface of carcasses during the slaughter process (Oosterom, 1991). *Salmonella enteritidis* can be detected in about a fifth of all poultry (Fisher, 1999).

Salmonella contamination of poultry products can cause diarrhoea, vomiting and fever in humans that may last for several days (Zoonoses Report, 1998). If the case is serious, it may result in medical care, hospitalisation, or even death (PHLS, 1998). In general, children under the age of five, pregnant women and the elderly are more at risk than other people (Which?, 1996; IFST, 1998). For instance, 15 children became infected with *Salmonella* after picking up newly hatched chicks and needed hospital treatment for severe diarrhoea and fever (BBC, 2000). Some infected people will go on to develop pain in their joints which can lead to chronic arthritis (Facts, 2001). A study conducted by PHLS, London reported that illness is significantly associated with consumption of suspected food items. Fresh shell eggs, egg products and pre-cooked hot chicken are the common vehicles of *Salmonella* infection in sporadic cases (Cowden, Lynch, Joseph, O'Mahony, Mawer, Rowe and Bartlett, 1989). Infections are more frequent in summer months (Banatvala, Cramp, Jones and Feldman, 1999).

2.2.1.2 Campylobacter

Phillips (1995) suggests that *Campylobacter Coli* is the most common cause of diarrhoea in the UK associated with eating food contaminated with living bacteria. The presence of *Campylobacter spp.* in chicken possibly poses the greatest health risk (IFST, 1995a). Previous studies show that between 30 and 100 percent of broilers at the point of retail sale have been contaminated on the surface with *Campylobacter spp.* (Phillips, 1995). A recent study in the US found that 88 percent of poultry sampled from local supermarkets tested positive for the bacteria (Hingley, 1999). In the UK, the incidence of *Campylobacter* rose from 26,000 cases in 1985 to 48,000 cases in 2000 (Which?, 2001b). It is now responsible for over half the cases of reported food poisoning (FSA, 2000b), and has become the single biggest identified cause of food poisoning in the UK (FSA, 2001b).

Smith (2001) suggests *Campylobacter* be commonly found in the intestinal tracts of a large number of warm-blooded animals without causing any symptoms of illness. Yet, it may cause *Campylobacter* infection if people eat contaminated undercooked poultry meat or drink raw contaminated milk. The infection can lead to mild to severe diarrhea, fever, nausea, vomiting, and abdominal pain. If the case was serious, urinary tract infection, meningitis or acute paralysis could happen in both children and adults (Hingley, 1999).

2.2.1.3 Escherichia Coli

Escherichia coli is a bacterium naturally found in the intestines of man and animals that can cause food poisoning. This may be a result of poor handling at slaughterhouse where animal faeces contaminate the raw meat (IFST, 1996). Cattle appear to be the main source of infection. Most cases are associated with the consumption of undercooked meat, such as beefburgers, barbecued chicken or similar foods (FSAC, 1993; Attenborough and Matthews, 2000). Retail samples of chicken and turkey have been shown being contaminated with *E. Coli 0157:H7*, indicating the possibility that poultry are also carriers of the organism (Phillips & Roscoe, 1996). Evidently *E. Coli* can multiply in food, but only large numbers of the organism cause infection, except in the case of *0157* which can have a very low infective dose (Eley, 1997; Attenborough and Matthews, 2000).

Infection may produce symptoms from mild diarrhoea to a severe or fatal illness, such as haemolytic uraemic syndrome or kidney failure. Children under 4 years have the highest infection rates. Outbreak of *E. Coli 0157* appears to be low in comparison with *Salmonella* or *Campylobacter*, but it tends to be a cause of serious illness and even death (FSA, 2000b).

2.2.1.4 Listeria Monocytogenes

Listeria monocytogenes is found widely distributed in the environment and is present in the intestines of many domestic and wild animals, including chickens, sheep and cattle. A recent confirmed case of contaminated turkey and chicken products with *Listeria* was reported (Raeburn, 2001). Owing to the extended incubation period of about ten weeks before development of the disease, it is difficult to determine the food implicated in the infection (IFST, 1995b). A delay usually occurs between the consumption of contaminated food and the symptoms of *Listeriosis* that it would let the actual cause of the illness pass unrecognised. Correspondingly, cases of illness attributed to *Listeria monocytogenes* are therefore relatively rare.

Although the majority of people will either be unaffected or at worse, have mild fever for a short time, *Listeria monocytogenes* can be dangerous for vulnerable groups, such as pregnant women and the infirm. An outbreak of *Listeriosis* in 1999 linked to processed meats and hot dogs led to nearly 100 illnesses and 14 deaths in the United States (Dulen, 1999). *Listeriosis* can also give rise to meningitis and septicaemia (Duggan & Phillips, 1998). Owing to the serious and fatal consequence of the incidence, *Listeria monocytogenes* has now therefore attracted a lot of attention.

2.2.1.5 Clinical Features of Illnesses Produced by Food Poisoning Bacteria

A summary of information about the above four types of prevalent food poisoning bacteria are presented in Table 2.1.

Table 2.1 Illnesses Produced by Food Poisoning Bacteria

Bacteria	Illness
Salmonella spp.	Incubation period: 6 to 72 hours; usually 12 to 36 hours Duration: 1 to 7 days Symptoms variable: diarrhoea, abdominal pain, headache and sometimes vomiting Fever nearly always present
Campylobacter jejuni	Incubation period: 2 to 10 days Duration: 5 to 7 days or more Symptoms variable: flu-like symptoms with abdominal pain and fever followed by diarrhoea, often sever and nausea, vomiting
Enterohaemorrhagic E. Coli (includes E. Coli 0157)	Incubation period: 2 to 12 days; usually 2 to 8 days Duration: approximately 8 days Symptoms variable: Severe abdominal pain, serious diarrhoea, occasionally vomiting; little or no fever. Possibility of developing into haemolytic uraemic syndrome (HUS)
Listeria Monocytogenes	Incubation period: from one day to a few weeks Duration: usually a few days Symptoms variable: nausea, vomiting and abdominal pain prior to fever. Possibility of leading to meningitis in patients with an underlying condition. Pregnant women may also suffer flu-like illness

(Source: Board, 1983; Eley, 1992; Trickett, 1997; Hingley, 1999; Attenborough and Matthews, 2000)

2.2.2 Chemical Hazards

Chemical hazards are associated with the use of chemical additives, processes and controls in the agricultural and food industries. Chemical usage includes the use of agri-chemicals, growth control hormone, feed conversion enhancers and anti-biotic treatments to increase or protect market yield and/or quality of crop and livestock products (NFU, 2000a). Chemicals may be widely used in the processing and distribution stages of the food supply chain to provide or preserve specific product features, such as prevention of mould growth (Foodsense, 1996a). Unwanted chemical residues may arise due to inappropriate use or management, in some cases due to operations carried out in a generally polluted environment.

Food products may purposely or unintentionally contain chemicals. Although the uses of both pesticide and antibiotic are regulated in the UK by the Department of Environment, Food and Rural Affairs (DEFRA), a small amount of chemicals such as dioxins may be dangerous (Foodsense, 1996b). In addition, chemical contaminants are not eliminated by cooking or sterilising (Pigott and Kirby, 1999). Concern about high levels of chemical use and the implications for consumer health has led to the inclusion of chemical related risks in the concept of food safety (Wandel, 1994; Pretty, 1998; Meikle and Brown, 1999; Smith and Riethmuller, 1999).

2.2.2.1 Pesticide Residues

Pesticides are designed to kill pests, however, pesticide residues in food may also be a potential risk to people and the environment, and their cumulative effects may be poisonous after a period of time (Foodsense, 1994). The overuse and misuse of pesticides have caused consumers to question the safety of fresh produces due to a fear of pesticide residues (Miles and Frewer, 1999). A study of animal toxicity shows that about 20 percent of pesticide residues in the feed are capable of causing cancer when fed daily to laboratory animal over a lifetime (IFIC, 1995). There might be a possibility of contaminated feeds eaten by chicken, though the pesticide residues may not have immediate effect on the chicken, however the meat may be unsafe to eat.

Consequently, the consumption of the pesticide residues in meat may be harmful to human health (Foodsense, 1996c). Though the pesticide levels are within safety margins, the public have consistently expressed their concern about pesticide residues in food, (Chipman, Kendall, Auld, Slater and Keefe, 1995; FSA, 2000c) and rank it relatively high in risk (Sparks and Shepherd, 1994a).

2.2.2.2 Antibiotics and Growth Hormones

Antibiotics are substances produced by microorganisms that kill or inhibit other microorganisms (Todar, 1996). They can be used to cure sick animals or speed up their recovery (NFU, 1998). Growth promoters, a particular type of antibiotics that help livestock to grow bigger and faster, have been used extensively in animals' feed and water. Subsequently, the widespread use of antibiotics promotes the spread of antibiotic resistance (CDC, 2000). The Food and Drug Administration and Centers for Disease Control and Prevention agree that the agricultural use of antibiotic is a main source of antibiotic resistance among foodborne pathogens (EMS, 2000a).

Sanders (1999) points out that continual use of antibiotics as growth promoters for poultry may result in the emergence of multidrug resistant strains of pathogenic bacteria, such as *Salmonella* and *Campylobacter*. This process may reduce human resistance to antibiotics (Khachatourians, 1998; Gottlieb, 2000; Wenzel and Edmond, 2000) due to the complicated treatment decisions leading to treatment failure (Whitney, Farley, Hadler, Harrison, Lexau, Reingold, Lefkowitz, Cieslak, Cetron, Zell, Jorgensen, Schuchat, Facklam, and Bennett, 2000). The World Health Organisation reports that infections caused by resistant microbes fail to respond to treatment, resulting in prolonged illness and greater risk of death (EMS, 2000b). In view of these effects, public concern of the use of growth-promoters in broiler chickens has increased (McKellar, 1999; Jarvis, 2001). Besides, the growing use of chemicals has given rise to a suspicion of increased risk of poisoning (Collins and Oddy, 1998). The media shows that sales of organic food have risen dramatically in the major supermarkets following the reports (Guardian, 1999b; Meikle, 1999b).

According to the Scientific Committee on Veterinary Measures relating to Public Health (SCVPH), the use of growth hormones result in high residue concentrations in tissues of treated animals (EC, 1999a and 1999b), and that could cause increased risk of cancer in humans (EC, 2000). Growth hormones have been banned in poultry production for years though they are still fed to other livestock.

2.2.2.3 Food Additives

Food additives such as preservative, colourings and flavourings are added for specific purpose (FSAC, 1993). For instance, the preservative can keep food wholesome until it is eaten. Food colouring is to restore the colour lost from food during processing and make the food look brighter. Flavour enhancers include sweeteners, emulsifiers and stabilisers that make flavours stronger and retard baked goods from going stale. Antioxidants can stop fatty foods from going rancid and protect fat-soluble vitamins from the harmful effects of oxidation. The use of these additives is approved by those scientists and doctors, who check safety evidence for the Government (Foodsense, 1996d).

Additives permitted are considered safe to eat for everyone apart from those who have allergic reaction to any particular ingredient (Foodsense, 1994). Public view about chemicals in foods is however different. Some still raise questions about the necessity of using additives to food. For instance, many people accept preservatives for keeping food longer, but react badly to some additives, such as colourings. Because additives are unnatural, people perceive a risk in the consumption of food with additives (Foodsense, 1996d).

2.2.3 Technological Hazards

Technological hazards refer to the possible negative consequences of technological advancements in food products, such as food irradiation and genetic modification of food. In general, technology has contributed multiple benefits in terms of food safety and increased food availability. But it is not unusual for the public to show their concern about new technologies. Clarke and Moran (1995) cite that technological advancements are usually controversial and it is difficult to predict how consumers will accept them. Special consideration may be required before raising consumers' awareness of new development (Jones, 1996).

2.2.3.1 Food Irradiation

Food irradiation is a processing treatment applied to food. The process involves passing the food through a radiation field at a set speed to control the amount of energy or dose absorbed by the food in order to control food spoilage and improve food safety. Food irradiation provides an alternative to, and extends the traditional methods of preservation, but it should never be used as a substitute for good manufacturing practices (IFST, 1999a). For instance, the application of irradiation in poultry or poultry products can reduce *Salmonella*, *Campylobacter* and other food poisoning bacteria.

Despite the benefit in the application of food irradiation technique, the irradiation process is not suitable for all products (FSAC, 1993; Ahmad, 1995; IFST, 1999a). There are some potential risks to product quality with the technique. For examples:

- damages caused by irradiation in some fruits, such as avocados, lemons and peaches;
- off-odours in food with high fat contents, such as fatty fish and some dairy products;
- Changes in flavour or decrease in vitamin with high protein contents, like meat and poultry;
- the resistance of some bacteria to irradiation could limit the shelf life of irradiated food;
- the presence of bacterial toxins formed before irradiation can still exist and cause food poisoning;

The use of irradiation technology is controversial. The word 'irradiation' carries negative perception to some people with association of atomic explosions or nuclear reactor accidents (Henkel, 1998). A survey conducted by the UK Consumers' Association in 1990 showed that over one-third of consumers did not favour the irradiation of food (Harris, 1990). Older age groups in particular disapprove the use of irradiation in food preservation (Ahmad, 1995), partly reflecting a limited understanding of the purpose and method of food irradiation (Miles & Frewer, 1999).

2.2.3.2 Genetic Modification (GM)

Genetic modification (GM) is "a process that allows scientists to change plants or animals by identifying and inserting specific genes to promote desirable features like better flavour, resistance to disease and higher nutritional content" (NFU, 2000b). The House of Lords Select Committee on Science and Technology described "GM as a key enabling technology facilitating major innovation in health care, chemical, agricultural and food sector leading to the invention of new drugs, agrochemical, and breeding of plants and animals" (Ford and Murphy, 1998). According to Food for Our Future (1997), genetically modified vaccines are being developed to protect cattle, pigs and poultry against a variety of serious diseases, it may improve the meat quality. Apart from this, it may also increase efficiency of food processing (Marshall, 1994). To conclude, GM offers potential significant improvements in quality and quantity of world's food supply (IFST, 1999b).

Despite all benefits from the process, genetic modified foods have become one of the biggest food safety concerns following the publication of a controversial study proving the possible health problems in rats fed with gene-altered potatoes (Gregoriadis, 1999; Pollack, 1999; Weiss, 1999). A Guardian/ICM opinion poll in 1999 reported that nearly one third of the public were not prepared to wait for the outcome of further trials and requested banning GM crops outright and 56 percent said that GM food were unsafe to eat (Travis 1999). A poll by the national Consumers' Association in August 1999 showed that 85 percent of people were worried about being denied access to the full facts on GM foods (Gregoriadis, 1999).

Some scientists claim that there is insufficient evidence to estimate the risks of GM foods to public health and the environment (Ford and Murphy, 1998; Barboza, 1999; Jacobs, 1999). The precautionary principle, however, demands that lack of evidence of negative impacts is not a reason for adopting a technology if there is a reasonable chance that such impacts could arise; that is where there is a technical risk, however small. The continuing debate, characterised by the diversity of opinions expressed by scientists and other experts, further raises the sense of uncertainty about GM foods amongst a less scientifically informed public. It is important therefore that the scientific debate is translated for general consumption.

Consumers' reaction to the development of biotechnology in food production and subsequent acceptance of result may be affected by perception of both risks and benefits associated with the new technique and its applications (Frewer, Shepherd and Sparks, 1994a; Frewer, Howard and Shepherd, 1997). Many consumers are convinced that GM technology will benefit suppliers rather than consumers, with the latter, and possibly society as a whole, carrying the risk of negative consequences. Most people have a limited understanding of GM technology because it is relatively new and complex (Miller and Huttner, 1995). Greater knowledge, supported by balanced and informed debate, with an emphasis on consumer education are key determinants of consumer confidence in food safety.

Indeed, where consumers have been less aware of GM inputs, as in USA in the case of food additives such as Soya, GM technology has been less of an issue, at least until US GM exports were challenged in European markets (Jacobs, 1999). In a global market, awareness and understanding of food safety issues are also traded commodities.

2.2.4 Nutritional Hazards

Nutritional hazards refer to the imbalance of fat, salt, cholesterol, calories, sugar, and mineral intakes in the diet. The consequence of diet-related health risk is often of equal concern to other food scares such as *BSE*. (Hart, 1997). Different nutrients affect health in ways that are quite well understood. A prolonged deficiency or excess of any one of the nutrients mentioned above could lead to health problems, such as anaemia, heart disease, obesity, bowel cancer, diabetes and high blood pressure (FSAC, 1993). For instance, high intakes of fat and protein are associated with elevated risk of colon cancer (Taylor, Steer and Gibson, 1999). High salt intakes are associated with strokes (Bender, 1986). High sugar may cause dental decay or impoverish the diet (Kipps, Eves, Noble and Noble, 1994). A diet high in saturated fatty acid leads to an increase in blood cholesterol, the higher the blood cholesterol levels the higher the risk of having a heart attack (Bender, 1986). Maney and Plutzer (1996) report that the public has expressed their concern what those foods linked to heart disease, cancer and so forth by demanding healthier food.

Statistics from the National Food Survey of Ministry of Agriculture, Fisheries and Food (MAFF) show that the proportion of food energy from fat in the national diet has continued to decline. The figure fell to 37.7 percent in first quarter, 1999 from 39.7 percent in 1996 and 41.7 percent in 1992. However, fat still forms too large a part of energy intake (Food Facts, 1999a and 1999b). Nevertheless, the survey also found that most adults are eating more than the recommended amount of fat and saturated fats (Foodsense, 1996e).

People are becoming more concerned about the nutritional value in food, since nutrition imbalance can lead to serious health problem. (Foodsense, 1996e). Poultry meat however is considered to be comparatively healthy by many people. Bayliss (1995) suggest "Poultry meat has a low energy value, is nutritious and provides an important source of high-quality protein containing essential amino acids. 65 percent of its fatty acids are unsaturated. There is a comparatively low fat level and 75 percent of which can be removed with the skin by the consumer."

There is a concern about the level of fat, sugar and salt in chicken processed products. Moreover, convenient products such as chicken kiev, chicken nuggets have been replacing home-prepared food such as fresh raw chicken steadily in the past decades (Bender, 1986). Bender (1986) states that many processed foods are already cooked and require reheating before being eaten. The nutrients such as vitamin B and C may be damaged in food processing. Inevitably, preservatives, fat, sugar and salt may be added to the food in order to make the processed food such as chicken pie more acceptable in terms of flavour, texture and colour.

2.3 Characteristics of Food Risk

Extensive studies have been conducted to associate the source of food-related risk with consumer risk perception (e.g. Frewer, Shepherd and Sparks, 1994b; Frewer and Shepherd, 1995; Raats and Shepherd, 1996; Saba, Rosati and Vassallo, 2000). It seems that the latter is out of line with the technical assessment of risk (Lindheim, 1989; Potter, 1998). Consumer behaviour during periods of food scare is often judged by scientists and industrialists to be due to irrationality or to ignorance of the true facts (Lofstedt and Frewer, 1998). In fact, public perception of risk reflects the limitations of scientific risk assessment due to the uncertainty of consequences (Slovic, 1986).

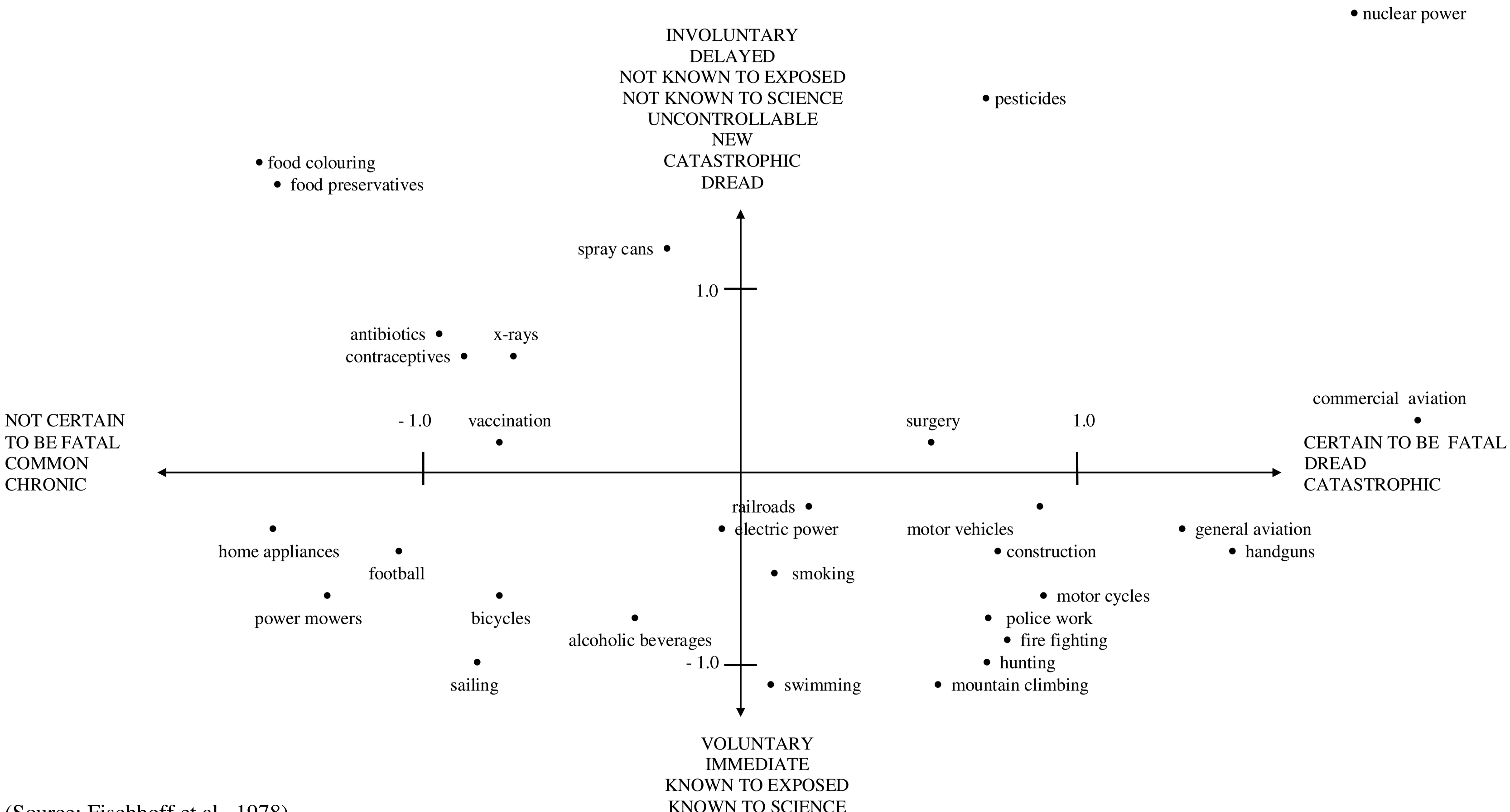
Research has shown that much of public's reaction to risk could be attributed to sensitivity not only to the technical but also to the social and psychological qualities of hazards (Kasper, 1980; Lave and Menkes, 1985; Slovic, 1998), such as foods produced with biotechnology (Wohl, 1998). Fischhoff, Slovic, Lichtenstein, Read and Combs (1978) have referred these latter social interpretations of risk which form the basis of consumer concerns as 'risk characteristics'. Sandman (1987) grouped these social dimensions of risk under the broad title of 'outrage' reflecting the degree to which people feel compromised by exposure to uncertain but potentially significant hazards without their consent and without potentially compensating benefit. For example, consumers may feel outrage that they are exposed to potential health risks by consuming unlabelled GM products, the benefits of which are perceived to accrue mainly to meat producers and processors rather than consumers. Subsequently, Sandman has used this concept to help organisations formulate communication strategies which attempt to minimise the potential damage of outrage amongst customers and other stakeholders when an organisation has misread public concern (Sandman, 1993).

2.3.1 Psychometric Paradigm

Past researchers have found that each hazard has its own domain and these are reflected in different levels of dimensions of risk characteristics. The latter are closely related to perceptions of risk. Starr (1969) has pioneered the work of the psychometric approach in a study to understand the degree of risk acceptance of different hazards. The analysis originally developed a method to weigh technological risks against benefits in order to understand society's previous responses to risk.

Fischhoff, Slovic, Lichtenstein, Read and Combs (1978) later develop this model which is known as psychometric paradigm to analyze individual hazard domains in the dimensions of psychological risk characteristics. These have been hypothesized to account for risk perceptions and attitudes such as severity of consequences, control over risk, immediacy of effect, voluntariness of risk, knowledge about risk, newness, chronic-catastrophic, and common-dread. They reveal two important factors leading to risk perception associated with a variety of hazards namely, 'technological risk' and 'severity' (Figure 2.2). Psychometric paradigm helps to locate each hazard within the two dimensions which comprise of a set of independent risk characteristics.

Figure 2.2 Factor Structure of Perceived Risk



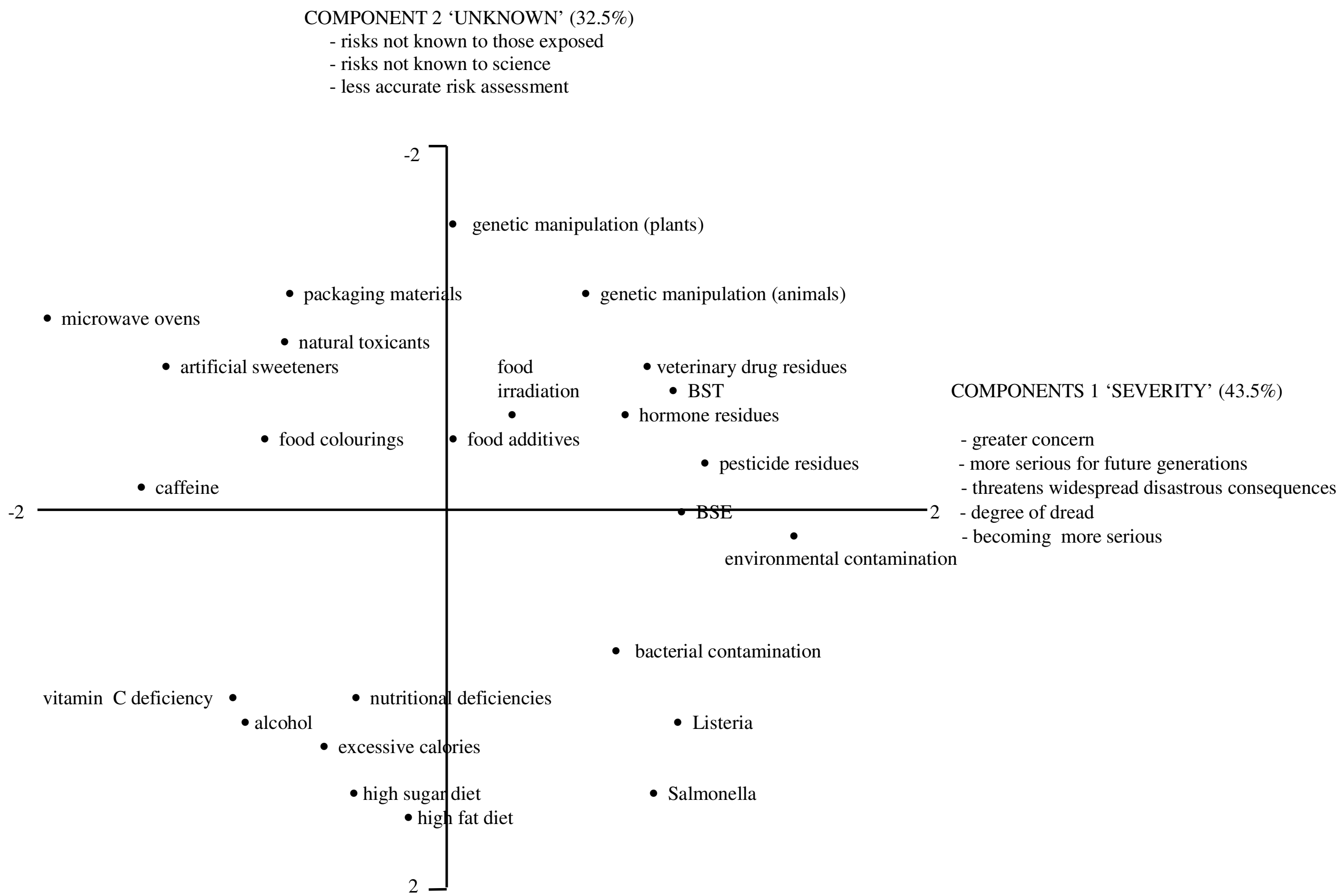
(Source: Fischhoff et al., 1978)

Slovic, Fischhoff and Lichtenstein (1980) further suggest that some risk characteristics can be correlated with each other across a wide range of hazards. Hazards perceived to be voluntary tend to be judged controllable; hazards with delayed adverse effects tend to be unknown to the public. Slovic (1987) uses the factor of 'dread' to capture variables such as uncontrollable, fearful, global catastrophic potential, fatal consequences, high risk to future generations, not easily reduced, risk increasing, involuntary. He relates the 'unknown' factor to the variables of not-observable, unknown to those exposed, effect delayed, new risk, and risk unknown to science. He labels a third factor as 'the number of people exposed to the risk'. The potential spread of a hazard is correlated with the factors of dread and unknown.

Building on this, Sparks and Shepherd (1994a) relate 'dread' to a variety of variables, such as concern, seriousness for future generations, threat of disastrous consequences, degree of dread, and risk becoming more serious. Fife-Schaw and Rowe (1996) also include the variables such as harm to vulnerable groups, likely effect on future generations, potential to cause serious harm to health, likely delayed effects and causes of worry. Sparks and Shepherd (1994a) further show that variables such as risks known to those exposed, risk known to science, and accuracy of own assessment are strongly correlated with the 'unknown' factor. Fife-Schaw and Rowe (1996) add other variables, such as the characteristics of individuals or organisations responsible for the hazard, the perceived adequacy of government regulations to protect people's health, and the reputation of organisations responsible for protecting people from harm.

Psychometric results emerged in a study associated within food by Sparks and Shepherd (1994a) suggested that microbiological hazards such as *Salmonella* and *Listeria* were high on 'severity' but low on 'unknown'. Technological hazards such as genetic modification were rated high on 'unknown' and a moderate rating in terms of 'severity'. Nutritional hazards such as high fat diet and excessive calories were rated low on 'unknown' and relatively low on 'severity' (Figure 2.3).

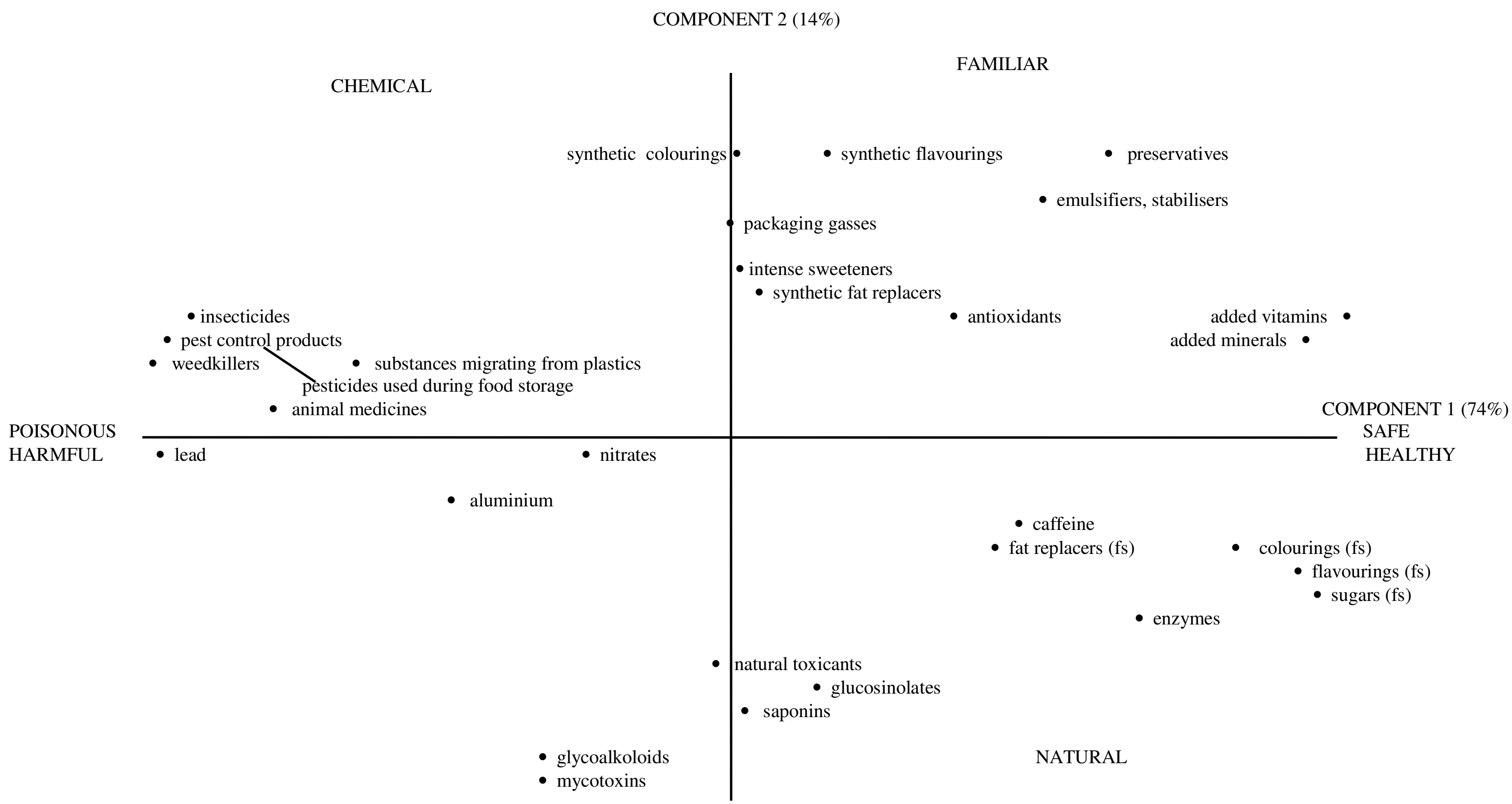
Figure 2.3 Location of Food-related Hazards within the Two-component Dimensions



(Source: Sparks and Shepherd, 1994a)

Raats and Shepherd (1996) in a study of perceptions of chemicals in foods reported that those chemical hazards such as pesticide and antibiotic residues, which are perceived to be harmful and poisonous, scored high on 'dread' factor. For food additives such as added vitamins and flavourings, which were perceived to be safe, were rated low on 'dread' and scored moderate on 'known' (Figure 2.4).

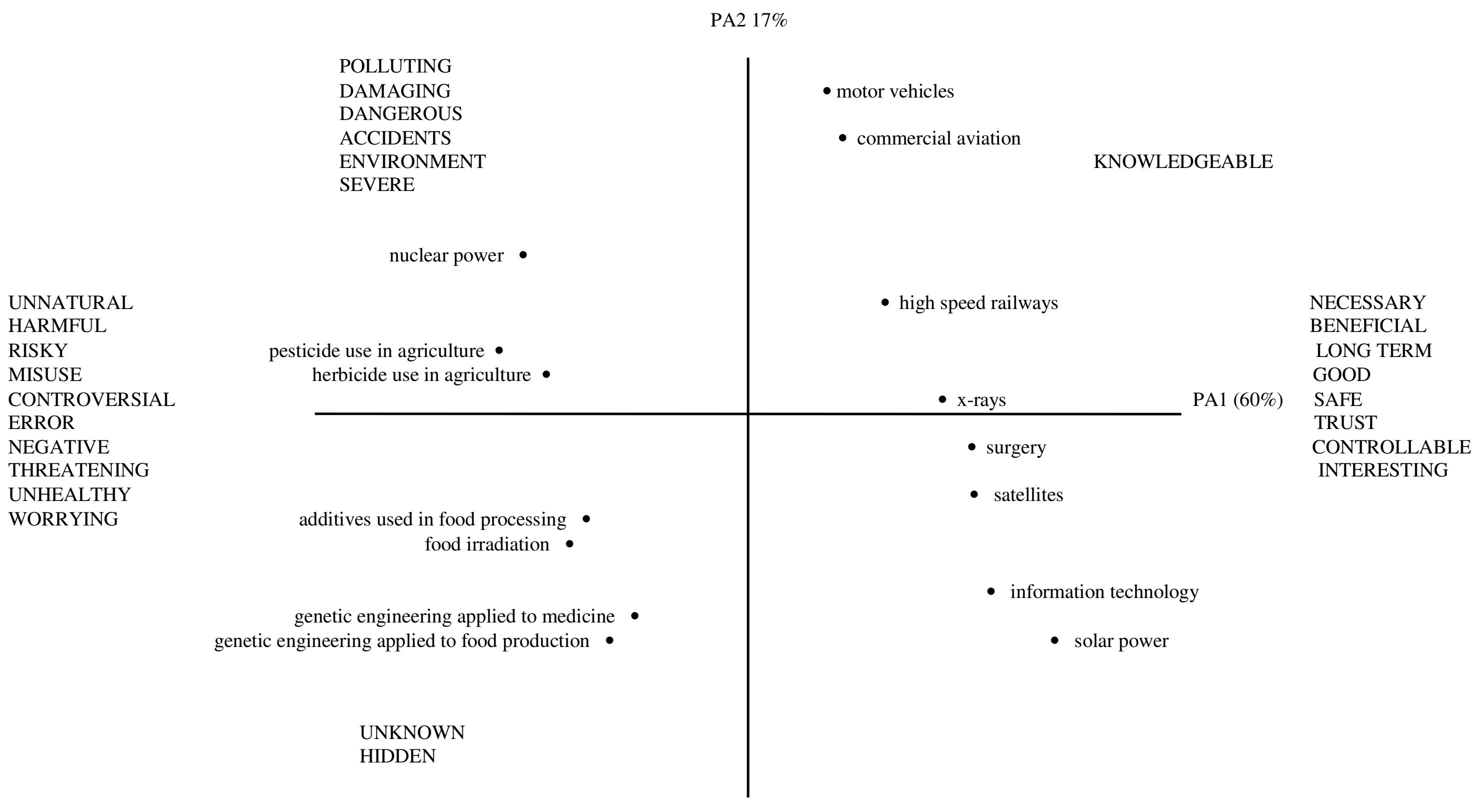
Figure 2.4 Location of Chemical Hazards within the Two-component Dimensions



(Source: Raats and Shepherd, 1996)

Frewer, Howard and Shepherd (1998) in a study of public attitudes to technology gave different combination of risk characteristics. Technological processes such as GM food, food additives, food irradiation and pesticide use in agriculture were all rated high on harmful, threatening, and risky, but ranged from medium to high on unknown and hidden (Figure 2.5).

Figure 2.5 Location of Risk Associated with Technology within the Two-component Dimensions



(Source: Frewer, Howard and Shepherd, 1998)

Frewer, Howard, and Shepherd (1995b) also cite that people very often characterize different food hazards by the influence of media coverage. The domain of food hazards lying between different level of the dimensions of risk characteristics may therefore change from time to time.

2.3.2 Food Risk Characteristic and Risk Perception

Consumer risk perception of food safety is not so much determined by the hazard per se but more with the social and psychological characteristics of a food hazard. The psychometric paradigm indeed helps to identify factors that relate to perception and acceptance of risk with respect to a food hazard. The use of the psychometric scaling and multivariate analysis techniques can produce quantitative representations of risk attitudes and perception. It then can provide an understanding of relativity in the social constructs determining public risk perceptions. Nevertheless, each characteristic of food risk may have its own distinctive impact on consumer risk perception.

The relationships between each risk characteristic and risk perception have been confirmed by many studies related to food or other hazards. Starr (1985) points out that public perception of food safety depends on how well the risk can be managed. In other words, public confidence can be restored if there is evidence to show that the food risk is under control. Furthermore, Frewer, Howard and Shepherd (1995a) cite that 'increasing perceptions of personal control may reduce perception of personal risks'. People put confidence on their own control of a food risk rather than others' control. For instance, people associate greater risk with circumstances and practices which they perceive are controlled by others, such as eating in restaurants, compared to situations in which they have perceived control, such as preparing and eating food at home. Moreover, under uncertain situation, people are likely to demand greater protection from potential harmful events if they have limited perceived control (Lave, 1980; Covello and Mumpower 1985; Slovic, 1987).

Alternately, people may generate their own estimates on risk with what they know about the nature of a hazard since it is not easy for them to access scientific estimates (Bostrom, Fischhoff and Morgan, 1992). People can make possible competent judgements by their past experience even if they lack full knowledge (Renn, Webler and Kastenholz, 1996). On the other hand, the judgement of risk may be biased if relevant information is missing (FAO, 1998). This tendency also applies to the expert in the absence of sufficient evidence (Slovic, 1987). In any case, a study on a range of food-related hazards showed that perceived personal knowledge about the hazard makes people feel more control over exposure of risk (Frewer, Howard, Hedderley and Shepherd, 1998).

Correspondingly, people want to know about the potential risk when they face it, even if the information may make them anxious (Fischhoff, 1989). A study shows that information provision related to the current state of the technology applications did not have much adverse influence on public perception of risk if the potential applications can be truthfully described (Frewer, Shepherd and Sparks, 1994a). For this reason, Jungermann, Schutz and Thuring (1988) suggest that a carefully planned information provided to public in considering their knowledge and feelings could make the message appealing to them. Otherwise, unclear information would be seen as biased and has a negative impact on perception (Lofstedt and Renn, 1997; Yee, 2001a).

Besides, people often perceive high risk if they think that they are not well informed and their right to free choice is compromised (Walkley, 1999). Starr (1969) reports that people accept risks from voluntary activities that may be 1,000 times as great as they would tolerate from involuntary hazards that provide the same level of benefits. Wandel (1994) found that people perceive food related health risk as more dreadful if it is involuntary than if it is voluntary. The same result has been obtained in research on industrial risk (Covello, 1991; Braus, 1994). For instance, hunting is a voluntary activity. Doves caught by hunting are perceived being safe to eat by hunters in the US even though doves from the hunting area are often contaminated with lead residues that could cause cancer in humans (Burger, Kennamer, Brisbin and Gochfeld, 1998).

In addition, a hazardous event, which is close in time or space, makes the risk easier to visualise and heightens the sense of risk (Lichtenberg and MacLean, 1991). For instance, research shows that recent experience of the *BSE* crisis has been translated into a general distrust of GM technology. James McCoy, Mintel's senior consultant on consumer goods argues that this will continue to beset the efforts of developing GM foods (Gregoriadis, 1999). With time, and in the absence of return events or reminders, memories fade and in some cases complacency may increase the real rather than the perceived risk. Regulation and legislation help protect against this tendency.

The dread factor reflects the observation that risk perception is shaped more by the severity of the consequences than the probability of occurrence. Potentially fatal events, however improbable, tend to focus the mind because the consequences are so severe (Covello, Sandman and Slovic, 1988). In spite of repeat re-assurances by Government that the probability of humans contracting new variant *Crentzfeldt-Jakob disease (*nv*CJD)* was extremely small, the severity of the consequences in many people's minds was sufficient to curtail beef consumption. The beef sector collapsed immediately after evidence of a possible link between the *BSE* prion and nv*CJD* in humans (Latouche, Rainelli and Vermersch, 1998).

People tend to perceive less risk in situations which are familiar to them than in those that are unfamiliar (Covello, Sandman and Slovic, 1988). Indeed, familiarity with a product, process or practice can breed complacency about the degree of risk, especially regarding the probability of occurrence. Conversely, people very often attribute high risks to food products if they have less knowledge of chemical or technological processes. People are in particular concerned if the risk has long-term effects or is harmful to the environment (Marris and Langford, 1996). Miles (1999a) argues that 'uncertainty' regarding probability and identity of hazard is judged to be serious where people believe that risks are unknown to scientists or risk regulators, or where the latter hide the risk information from the public.

It is apparent that tolerance of risk is positively correlated with perceived benefit, the bigger the benefit the greater the willingness to take risk (Wandel, 1994). Frewer, et al. (1995b) point out that people very often link benefit and risk to specific applications of technology. They tend to expect low rather than high benefits of new technology (Frewer, Shepherd and Sparks, 1994a), and are therefore less willing to accept risk where such benefits are unproven or uncertain (Frewer, Howard and Shepherd, 1998). This appears to be the case with GM technology, where consumers perceive that health risks are insufficiently compensated by potential benefits to them as consumers. The rejection of GM food technology compares interestingly with rapid uptake of mobile phones, where users perceive benefits which appear to compensate for possible health risks.

Large-scale consequences very often attract more attention in the media than individual smaller consequences (Slovic, Fischhoff, and Lichtenstein, 1980; HMSO, 1995). Kasperson, Renn, Slovic, Brown, Emel, Goble, Kasperson and Raticks (1988) argue that massive media coverage is more likely to heighten the perception of risk and demand for action to alleviate perceived risk. Indeed, society is not willing to accept risks that affect a great number of people, not least because a greater proportion of the population will feel outraged by the exposure and seek redress. For instance, a call for food hygiene training for butchers and improved hygiene in abattoirs was raised immediately after 21 pensioners in Lanarkshire died in an *E. Coli* outbreak linked to contaminated meat products (Guardian, 1999b).

Generally, if the perceived risk is high, people want to see risk reduced, and the more they want to see strict regulation to achieve the desired reduction in risk (Slovic, 1987). Regulation in some sense will help to reduce perceived risk by the public. It sometimes depends on the degree to which people trust the government ability to manage the hazard and the level of enforcement of the rules. The trust in regulation and legislative control may be reduced if the government has been seen to work for industry rather than public interests (Frewer, Howard, Hedderley and Shepherd, 1996).

By and large, food risk characteristics have definite impact, positively or negatively on risk perception. The extent of the effect of each risk characteristic however varies according to individual food hazard or hazard type. The first research hypothesis is therefore developed:

H_1: There is a causal relationship between food risk characteristics and consumer risk perception.

2.4 Risk Perception

The preceding sections have defined risk and risk perception in the context of potentially hazardous and harmful consequences to consumers, together with a discussion of the effects of individual risk characteristics on consumer risk perception. This section focuses on understanding the relationship between consumer risk perception and consumer behaviour in the case of food hazards. The concept of perceived risk in consumer decision making under uncertainty was first proposed by Bauer (1967). He suggests that it is not the objectivity of risk that motivates consumer behaviour, but subjective impressions of it, even if consumers could calculate correctly the risk involved. He further argues that once a risk has been perceived in a purchase situation, there seems to be some reasonable evidence that subsequent consumer behaviour is shaped by this risk perception.

2.4.1 Dimension of Risk Perception

Many studies have attempted to measure risk perception in a broader marketing context (e.g. Bauer, 1967; Cunningham, 1967b; Taylor, 1974; Mitchell and Greatorex, 1988; Yavas, 1992; Agrawal, 1995). Their research is based on a risky or uncertain outcome in a purchase decision where a product does not perform according to expectations. Such research focuses on outcomes that are more disappointing than they are threatening to consumer welfare; more to do with a product under-performing rather than being unsafe. The consumer may be unhappy but is not necessarily exposed to a hazard.

Cox (1967a) defined perceived risk as a function of subjective uncertainty perceived by the consumer and the consequence of not satisfying the goals of the purchase decision. These included so-called performance and psychosocial goals set against the cost incurred. In turn, some kinds of consequent loss would be perceived if a particular goal is unlikely to be achieved. The consumer will be concerned about individual losses as the overall perceived risk increase, say for the scare of *Salmonella* in chicken. Apparently, damage to health is one such consequent loss regarding food safety issue. The concept comprises a set of interrelated multidimensional components.

The concept of risk perception as a multi-dimensional phenomena with the overall risk subdivided into various losses has been explored by a number of researchers (e.g. Dowling, 1986). Pidgeon, Hood, Jones, Turner and Gibson (1992) suggest that a particular hazard may mean different things to different people and different things in different contexts. The multidimensional measures of loss component would vary according to the nature of the product (Zikmund and Scott, 1977) or purchase situation (Stone, and Gronhaug, 1993). For example, Roselius (1971) identified four types of potential loss in his framework for perceived risk, namely: hazards which are dangerous to health, loss of money, time wasted in replacing the product and loss of ego or self-esteem when the product fails. Kaplan, Szybillo and Jocoby (1974) add performance loss to this framework, but exclude time loss. They also separate ego loss into psychological and social factors. Mitchell and Greatorex (1988) concentrate on financial, functional, physical and social types of loss in their study of consumer risk perception in the UK wine market. In a study of predominantly non-safety consumer risk perception in grocery retailing, Mitchell (1998a) identified five components of risk perception, namely: physical, performance, financial, time, and psychosocial. He argues that this multi-dimensional analysis significantly improves the understanding of risk perception (Mitchell, 1999).

Roehl and Fesenmaier (1992) cite that the measures of risk perception would be evaluated according to the context of interest. They operationalize seven types of risk for the study of international travellers by including physical, financial, times, social, psychological, equipment and satisfaction risk. In the context of service marketing, Mitra, Reiss and Capella (1999) measure perceived risk by six components of physical, performance, financial, time, social and psychological, as does Tse (1999) in his study of consumer perception of product safety in electronic goods. Health related loss seems very often to be associated with consumer food choice (Tregear, Dent and McGregor, 1994; Magnusson, Arvola and Hursti, 2001).

The multi-dimension of perceived risk in this marketing context can provide a useful framework for assessing the link between food safety and risk perception with respect to potentially hazardous and harmful consequences to consumers. Regarding food safety, the goal is to acquire food products that have the desired consumption attributes, are safe to eat, and are free of contamination and therefore free of worry to the consumer. Correspondingly, the uncertainty of achieving food safety goals may lead to some possible consequent losses for consumers as shown in Table 2.2.

Table 2.2 Components of Perceived Risk Associated with Food Safety

Perceived risk component	**Implication**
Physical loss	Negative health impacts on consumers associated with decline in food safety associated with microbiological, chemical, technological or nutritional factors.
Performance loss	The taste and/or nutritional value of food product is adversely affected by the food hazard.
Financial loss	The cost of replacing the spoiled food, paying for medical treatment or loss of income due to sickness.
Time loss	Time, convenience, effort in repurchasing and time loss due to illness.
Social loss	Poor food choice leading to social embarrassment if the food product is contaminated.
Psychological loss	Worries or concerns experienced by consumers that consumers are exposed to safety risk.

(Source: Yeung and Morris, 2001a)

2.4.2 Measurement of Risk Perception

Cunningham (1967a) recommends a two component model to measure risk perception comprising the probability of a loss occurring and the magnitude or seriousness of the loss once it has occurred. This two component model of risk perception has been adopted by researchers for its practicality purposes. Yavas, Verhage and Green (1992) argue that the two component model can provide a basis for risk measurement when applying this model in a study for global products. So does Yavas Riecken, and Babakus, (1993) in a study of donation behaviour. Dowling and Staelin (1994) suggest that consumer risk perception in a risky purchase situation can be explained more clearly by using two components of uncertainties and potential adverse consequences than one combined component.

Risk components have been measured in scalar quantities of low through to high in order to reflect perceptions (for example Mitchell, 1998b), in some cases either multiplied (Cunningham, 1967a) or added (Lanzetta and Driscoll, 1968; Bettman, 1973a; Horton, 1976) to derive an estimate of total perceived risk.

This study adopts the additive model and the equation of risk perception is:

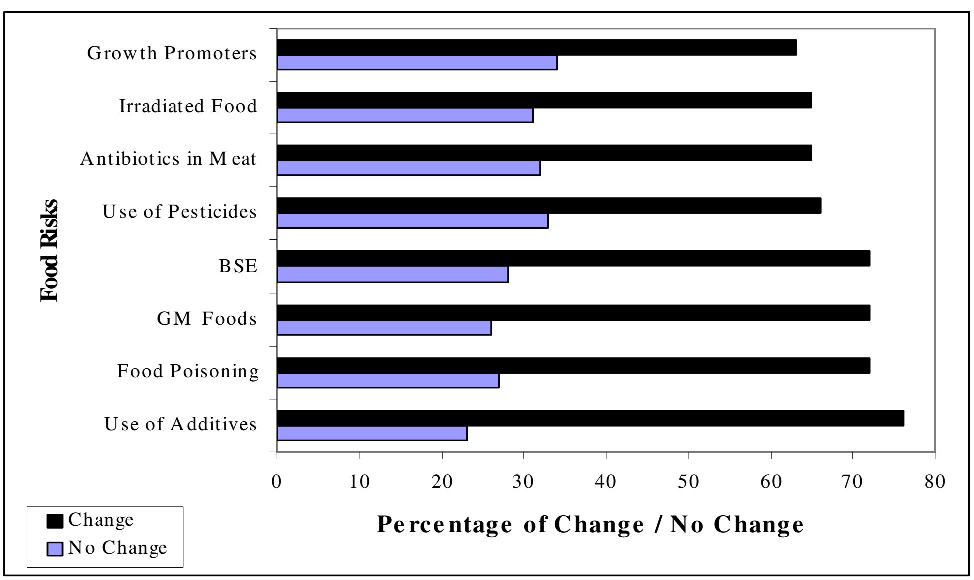
Risk perception = occurrence of risk + seriousness of loss

The two components are assumed to be equal weighting in the equation, though there is suggestion that the seriousness of loss component is less important (Mitchell, 1999). On the other hand, Slovic and Lichtenstein (1968) and Horton (1976) discover that the seriousness of loss is much more important in determining risk than the probability of occurrence. Subsequently, Diamond (1988) provides empirically evidence to support their view. Mitchell (1999) concludes that the evidence for rejecting the equality assumption still requires further research. This study applies equal weighting to the two components not only for simplicity, but also for reason discussed in Section 3.6.3.

2.4.3 Risk Perception and Purchase Likelihood

In a general food purchasing situation, consumer purchase behaviour is driven by a number of personal factors, such as preferences, beliefs, social values, experiences, motivations, and more specifically whether consumers may have allergic conditions to a particular food which influence their attitudes and purchase behaviour (Conner, 1993; Kuznesof, Tregear and Moxey, 1997). Mitchell and Greatorex (1988) however suggest that consumers purchase those goods of the least perceived risk with all others factors being equal. With respect to food safety, concern about food risks is found to be a major factor in consumer purchase decision (MLC, 2001). For instance, a recent consumer survey with 3,153 respondents revealed that between two-thirds and three-quarters of the respondents who were concerned about a particular food risk had changed their eating habits as shown in Figure 2.6 (TNS, 2001). This demonstrates the impact of perceived risk on consumer behaviour since concern is highly correlated with the former as discussed in Section 2.3.2.

Figure 2.6 Changes of Eating Habit in Relation of Concern about Food Risks



Source: TNS (2001)

Recent research shows that risk perception and purchase behaviour are causally linked: the former is an important explanatory variable of the latter. Other studies highlight the importance of the subjective nature of risk perceptions in purchase behaviour, providing evidence of a negative relationship between risk perception and purchase likelihood. For instance, Mitchell and Greatorex (1989) believe that the demand of egg products and soft cheese dropped because of a perceived risk in both products. Huang (1993) reports, in an empirical study of residue-free produce, that consumers show a tendency to avoid food products which are in their view potentially contaminated. In a similar context, Eom (1994) confirms that consumers refrained from produce perceived to contain pesticide in order to reduce health risks. McIlveen, Abraham and Armstrong (1999) in a study of consumer meat consumption show that 74 percent of consumers decreased meat intake due to recent food scares

This study focuses on how consumer perceived risk affects future purchase in the cases of concern about food safety. All other factors are therefore kept constant, that is, assuming consumer risk perception is the only factor shaping future purchase decision. The related hypothesis to this will be:

H_2: There is a negative relationship between risk perception and purchase likelihood.

2.5 Risk Reduction

Where consumers perceive risk, they often develop strategies to reduce risk that enable them to act with relative confidence and ease in situations when the outcomes and consequences cannot be anticipated (Bauer, 1967; Cox, 1967a). Roselius (1971) observed that consumers tend to adopt one of four broad actions to reduce perceived risk in a purchase, namely to:

- Stop, permanently or temporarily, the purchase of offending product, such as adopting a meat free diet;
- Reduce the purchase of the offending product and thereby reduce the exposure to perceived risk, such as eating less meat;
- Shift from one product to another similar type of product with less perceived risk, or for one which there is greater tolerance, such as switching from beef to poultry; or
- Continue to purchase and absorb the unresolved risk, indicating that the perceived risk associated with a particular product is tolerable and no greater than alternatives.

The greater the perception of risk in terms of probability or consequences, the greater is the likely action to reduce the risk. Most purchasers appear to be risk averters, more often motivated to avoid mistakes than to maximise utility in purchasing (Mitchell, 1999), in particular, if the perceived risk exceeds their minimum tolerable level (Dowling, 1986). Risk aversion is likely to be heightened in the case of food safety related risk because the severity of the consequences to the consumer are much greater than purchasing risk associated with product under-performance. It is likely therefore that consumers will reduce purchases of an offending product once a possible food hazard is perceived.

2.5.1 Risk Reducing Strategies

Where consumers face unresolved risk, they will draw on a range of risk reducing strategies such as purchasing branded or quality assured products or seeking advice or endorsements from trusted sources. The strategies being used will depend on the tolerance to the perceived risk of an individual consumer. Roselius (1971) cites that the risk reducing strategies can serve as a catalyst to reduce risk of loss and in turn to facilitate the purchase. He further developed a notion of risk relieving devices and actions which consumers choose according to preference and the type of risk involved in the case that consumers have to absorb the unresolved risk. He identified eleven risk relievers including brand loyalty, major brand image, government testing, private testing, store image, free sample, money-back guarantee, shopping around, expensive model, endorsement, and word of mouth. Regarding a hazardous loss, brand loyalty, major brand image and government testing apparently drew positive response. Since the study did not focus on any particular product or purchase methods, the findings were applicable to general purchase situations.

Mitchell and Greatorex (1990) propose 14 risk relievers in a study of perceived risk in various product categories including food items, convenience and shopping goods as well as services. They include consumer guides, product information, cheaper choice, trial and special offers to the previous list, but exclude government and private testing. From their findings, brand loyalty is the most useful risk reliever for all classes but shopping goods. Consumer guides, expensive model, sales person's advice and product information are particularly useful for food products. They also conclude that personal source of information would be used in a high-risk situation. Similar risk reducing strategies were adopted in several studies, such as breakfast cereals (Mitchell and Boustani, 1994), and holiday purchase (Mitchell and Vassos, 1997).

2.5.2 Risk Reduction and Food Safety

Changes over time in technology and society are likely to impact on consumer attitudes towards risk and the range and selection of risk relievers, beyond those identified above. Continuing surveillance of risk perception is therefore necessary to accommodate changes in consumers' needs, motives and perceived risks (Mitchell 1998a). This is especially the case with respect to growing concerns about food safety when consumers seek good quality food at affordable prices, high food hygiene standards in store, and reliable and helpful information when food scares occur (Pugh, 1990).

This suggests the way in which consumers commonly seek risk relief, and the way that food suppliers might facilitate this in terms of quality assurance, price and information. Curlo (1999) cites that consumers choose those brands sold by producers with a favourable track record for quality. In this respect, product traceability has been a key issue in the wake of the *BSE* crisis, that is the ability to identify and determine the credentials of the farm and the carcass from which a particular cut of meat came (Whitworth and Simpson, 1997).

It appears, however, that major food multiples very often use price reduction or special offers to support sales and maintain purchases during periods of poor consumer confidence in a product. Consumers may be willing to trade-off risk against a discounted price. Erevelles (1993) shows that consumers generally perceived a higher price to be associated with higher financial risk should the product not perform according to expectations, but this may not be the case where the characteristic associated with higher price is that of safety assurance. Given, the perceived consequences of unsafe food, it is doubtful whether discount pricing is an appropriate strategy either from the buyer's or seller's viewpoint in the absence of other risk reducing actions.

Consumers view price as a communication of quality that high quality items always cost more (Shapiro, 1973). Indeed, some consumers are willing to pay marginally higher prices for quality assurance, in particular for the health concern. For example, some were willing to pay extra for organic food (Latouche, Rainelli and Vermersch, 1998), or some asked for untreated milk by paying a premium (Grobe and Douthitt, 1995). It is believed that willingness to pay a high price could reduce risk in chicken consumption, especially during periods of food scare. Of course, this assumes that food safety is a variable that distinguishes products, which under general circumstances, should not be the case. Airlines, for example, do not explicitly use flight safety as a distinguishing characteristic. But, during periods of heightened concern, whether for food or travel, can become a discriminatory factor and one for which some purchasers may be willing or able to pay. It is unlikely, however, to be a sustainable basis for product discrimination.

On the other hand, risk information is influential in consumer purchase decisions (Viscusi and Evans, 1998). Consumers wish to acquire more information if there are uncertain outcomes of purchase decisions (Taylor, 1974). Doubtless, information will allow a comparison of several products or brands and help consumers to evaluate the psychological and social consequences of purchasing a particular product (Cox, 1967c; Newton, 1967; Lynch, Marmorstein and Weigold, 1988; Mitchell and Greatorex, 1989). Alternately, consumers very often use various sources of information in a high risk purchasing situation, such as recommendations of family and friends, salesman's advice and scientific evidence (Arndt, 1967; Cunningham, 1967c).

Douthitt (1995) however suggests that information in form of labelling is important in reducing the perceived risks of new technologies. The labels on a product containing facts linked to long-term disease risk, such as cigarette could assist consumers in evaluations of food choices for maintaining healthy diet (Burton, Garreston and Velliquette, 1999). Agrawal (1995) also recommends that consumer would react to the information if manufacturers could design more effective information brochures and other promotional materials associated with health concern. On the whole, the need of seeking information will depend on the nature and magnitude of the risk that consumers perceive. Consumers will seek the information sources that can satisfy their particular information need (Cox, 1967b).

By applying the risk reliever framework, the possible risk reducing strategies regarding food safety concern are shown in Table 2.3.

Thus, the corresponding hypothesis will be:

H_3: There is a negative relationship between risk reducing strategies and consumer risk perception.

Table 2.3 Risk Reducing Strategies Associated with Food Safety

Risk reducing method	Implication
Brand identity	Well-known or reputable product
Brand loyalty	Same brand bought because of satisfaction in the past
Quality assurance	Marks or logos to reassure consumers of the product quality or traceability
Government testing	Food product tested and/or approved by an government laboratory or related institution
Private testing	Food product tested and approved by a private / an independent testing company
Expensive product	High quality associated with high priced product
Money back guarantee	Money back for spoiled food
Price reduction	Special offer for a particular product during food scare
Free sample	Food products used on a trial basis before buying
Store identity	Well-known or reputable supplier / organisation
Shopping	Shop around to compare product features on several brands in several stores
Labelling	Labels include product information such as ingredients, nutrition values, cooking instruction and so forth
Consumer guide/leaflet	Guidelines or information about food hygiene and food safety
Word of mouth	Friends or family recommendations
Endorsements	Endorsement or testimonials from a celebrity

(Source: Yeung and Morris, 2001a)

2.6 Conceptual Model of Consumer Food Purchase Relating to Food Safety

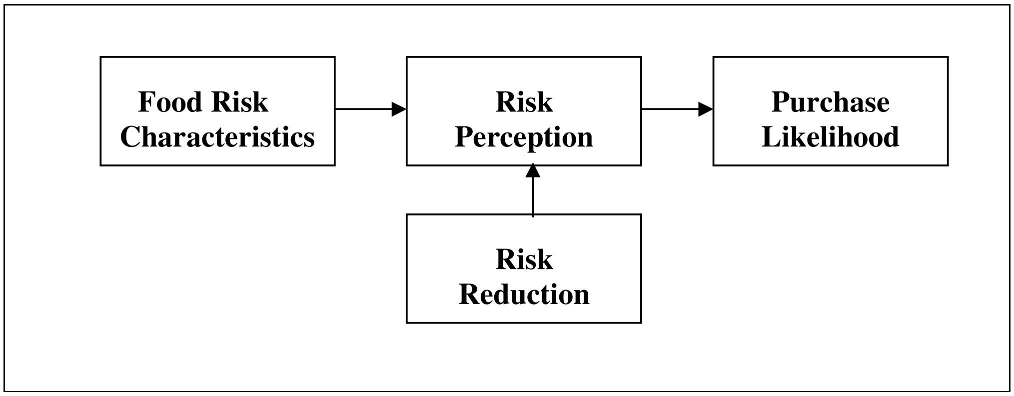
It is clear that the increase in number of reported cases of food poisoning and the incidence of food scares have aroused considerable public concern about the safety of food. The major sources of food safety risk were identified to be microbiological, chemical, technological and nutritional factors, but the relative importance of these factors to the cause of most consumer concern in the context of chicken meat is unknown at this stage. These different sources of risk appear to be associated with different risk characteristics, which strongly influence risk perception. Microbiological risk scores relatively high in terms of concern, severity of consequence, control over risk, voluntary to the exposure of risk. In contrast, technology hazards score relatively high in terms of knowledge of risk, uncertainty to future generation or environment, and regulations that were demonstrated by several studies using psychometric paradigm. Three factors, namely 'dread', 'unknown' and 'the number of people exposed to the risk' were used by previous researchers to capture these risk characteristics. Justification of using these three factors requires further investigation for this study since the characteristics of risk may be different in the context of food harzards in chicken meat and in a particular time period.

In this context, and consistent with the theory of perceived risk, it is appropriate to measure perception of food safety risk by two components, namely the likelihood that a consequent loss could occur and the seriousness of these consequences when they do occur. In particular, given the nature of food safety risk, consumer risk perception tends to give greater weight to the perceived potential severity of unhealthy food, than the probability of exposure. Furthermore, risk perceptions are heightened by particular characteristics of food safety risks, such as involuntary exposure or lack of controllability.

Consumer risk perception is evident in terms of physical loss, performance loss, financial loss, time loss, social loss and psychological loss. This theory of perceived risk appears applicable to the food safety aspects of purchase decisions, however, the terms used to explain general purchase behaviour require further clarification before carrying out an empirical study of consumer behaviour in the context of food safety. Empirical evidence during food scares, and to a lesser extent the literatures support the contention that, other things being equal, there is a negative correlation between perception of risk and purchase likelihood. This is one area where more research is justified. It is also apparent that consumers modify their purchasing decisions in order to relieve perceived risk: by reducing, shifting or postponing the purchase of the offending product where this is possible. Where consumers face unresolved risk in a general purchase situation, they draw on a range of risk reducing strategies such as purchasing branded or quality assured products or seeking advice or endorsements from trusted sources. The tendency to apply risk reducing strategies seems to increase in purchasing a product with hazardous and harmful consequences to consumers. Specific action to reduce risk during the period of food safety concerns justified further research.

From the preceding review of research literature, a conceptual consumer food purchase model relating to food safety has been constructed (Figure 2.7). This model shows the links between consumer risk perception and purchase likelihood and the influence of risk characteristics and risk reducing strategies used by consumers during periods of food safety concerns. The analyses of these links provide useful insight to help develop appropriate risk management and effective risk communication programmes. In this respect, the study topic and its potential contribution provide a valid justification for the research.

Figure 2.7 Conceptual Consumer Food Purchase Model Relating to Food Safety



(Source: Yeung, 2000a and 2000b)

2.7 Summary of the Chapter

This chapter has focused on the links between food hazards and purchase likelihood. The literature reveals showed that each food hazard has its own domain which is reflected in different dimensions of risk characteristics. The characteristics of risk are highly correlated with consumer perception of risk (hypothesis 1). This research goes beyond these findings by extending the source of food risk and its related risk characteristic to the theory of perceived risk which has been widely applied in a context of consumer purchase behaviour. According to perceived risk theory, past studies provide evidence of a negative relationship between risk perception and purchase likelihood (hypothesis 2). Moreover, perceived risk can be reduced by risk reducing strategies, thereby affecting purchase likelihood (hypothesis 3). The following conclusion can be drawn at this stage.

- Increasing numbers of food poisoning incidents in particular associated with *Salmonella* and *Campylobacter*, and incidents of food scare related to uncertain health consequences of potentially contaminated food have aroused considerable consumer concern. The degree of consumer concern may vary according to the nature of food hazard.

- Microbiological, chemical, technological and nutritional hazards that are associated with chicken meat consumption have been identified. Which hazard causes most consumer concern has not yet been explored. It is important to identify the food hazard of most concern as its impact reflects in the demand for the food products and shapes the appropriate response to managing these potential hazards.

- The characteristics of risk such as severity of consequences, immediacy of effect, concern, voluntariness of risk, perceived control over risk, perceived knowledge about risk, regulation and media have been identified to be associated with food hazards. Previous researchers have used three factors, namely ‘dread’, ‘unknown’ and ‘the number of people exposed to the risk’ to capture these risk characteristics.

- Previous research reveals that the characteristics of risk, such as concern, severity of consequence, control over risk, voluntary to the exposure of risk are highly correlated with consumer perception of risk. However, the effect of these risk characteristics on consumer perception of risk has not been determined by past research.

- Based on the definitions suggested by scholars in marketing and risk, it is considered appropriate to measure perceived risk as a combination of the likelihood that a consequent loss could occur and the seriousness of its likely consequences. This study adopted such approach to measure perceived risk.

- Perceived risk theory widely applied in the context of consumer purchase behaviour highlights the importance of the subjective nature of risk perception in purchase decision. Its multidimensional risk components in terms of physical loss, performance loss, financial time loss, social loss and psychological loss can improve the understanding of consumer risk perception. This theory can help to assess the impact of risk perception on purchase likelihood with respect to food safety risk.

- Risk reducing strategies such as purchasing branded products and products with quality assurance, and seeking product information that are adopted by consumers in general purchase situations appear to be useful to consumers during the period of food safety concerns. These strategies require further clarification to be applied into food safety risk.

- Drawing on the research literatures, a conceptual consumer food purchase model with respect to food safety risk has been constructed in order to assess the links between consumer risk perception and purchase likelihood relating to both food risk characteristics and risk reduction. Indeed, understanding these linkages provide insight to develop an appropriate risk management and effective risk communication. Empirical evidence to support this model is required.

This chapter has confirmed the significance of the study topic and justifies the conducting of the research. The next chapter focuses on selecting methods to progress the research.

CHAPTER THREE

3. RESEARCH DESIGN AND METHOD

This chapter discusses the approaches used to meet the aim and objectives of the study and to test the hypotheses proposed. The methods used for measuring food risk characteristics, risk reduction, risk perception and purchase likelihood are explained. The approaches for collecting and analysing data are discussed. The developments of consumer food purchase models which link consumer risk perception and purchase likelihood with respect to either food risk characteristics or risk reduction are presented. The statistical techniques used are given. A summary is included at the end of the chapter.

3.1 Procedural Flow Diagram of the Research

The structure of research design for consumer food purchase models is illustrated in **Figure 3.1**.

Figure 3.1 Procedural Flow Diagram for Research Design

Research Framework	To define a framework for the research by identifying risk characteristics, risk perception and risk reduction from the literature review
↓ Hypotheses Revisited	To direct the research approach with respect to the provisional hypotheses
↓ Research Approach	To work out the research design in order to meet the aim and objectives of the study
↓ Qualitative Study	To identify the main type of food risk in chicken meat product and to elicit the items of perceived consequent loss and risk reducing strategies by personal interview
↓ Quantitative Study	To confirm the relationship between risk perception and purchase likelihood in relation to either risk characteristics or risk reduction through 200 quota samples
↓ Study Appraisal	To confirm the research issues with the key informants from academic expert and industrialists
↓ Critique of the Research Approach	To review the strengths and the limitations of the research methods

3.2 Research Framework

Following an extensive literature review, a link between food risks and consumer purchase behaviour was determined. The relationship between risk characteristics and risk perception was identified through the studies of psychometric paradigm was defined. The relationship between risk perception and purchase likelihood was defined from the existing theory of perceived risk applied to the context of consumer purchase behaviour. A range of risk reducing strategies which was related to consumer risk perception was also identified in marketing research. Consumers are more likely to apply one or more risk reducing strategies if the perceived consequent losses are associated with potentially hazardous and harmful consequences to them than perceived risk associated with product under performance. This research extended the findings of the psychometric paradigm to merge with the existing perceived theory in order to assess the relationships among food risk characteristics, risk perception, risk reduction and purchase likelihood.

A list of food risk characteristics with respect to food risks in chicken meat in which the study focused was identified from the existing literature as below. The findings of such review were discussed with academic experts and industrialists.

- severity of consequences;
- immediacy of effect;
- concern;
- voluntariness of exposure;
- perceived control over risk;
- perceived knowledge about risk;
- regulation;
- media attention;
- activist influence.

Table 2.2 and Table 2.3 above were used to define a conceptual framework used for the assessment of consumer risk perception and risk reduction respectively. As this framework was derived from a marketing perspective, further investigation was carried out by a qualitative approach explained later in this chapter.

3.3 Hypotheses Revisited

For the development of the study, three hypotheses were generated and supported through literature review (Chapter 2) as below.

H_1: There is a causal relationship between food risk characteristics and consumer risk perception.

H_2: There is a negative relationship between risk perception and purchase likelihood.

H_3: There is a negative relationship between risk reducing strategies and consumer risk perception.

Hypothesis 1 assessed the relationship between the food risk characteristics and consumer risk perception. The items which capture the measurement of the food risk characteristics in the past studies were examined.

Hypothesis 2 assessed the relationship between consumer risk perception and future purchase likelihood. The items which capture the measurement of consumer risk perception were elicited from a qualitative approach explained later in Section 3.5. Items used in past studies were also examined against the criteria for food safety related risk.

Hypothesis 3 assessed the relationship between risk reducing strategies and consumer risk perception. The items which capture the measurement of risk reducing strategies were examined from the existing literature and also elicited from a qualitative approach explained (Section 3.5).

From the direction of these hypotheses, the research approach was designed accordingly as described in the following section.

3.4 Research Approach

Based on the framework from the literature review, consumer food purchase models linking consumer risk perception and purchase likelihood with respect to either food risk characteristics or risk reduction were proposed. The approach of research was carefully designed (Cooper and Emory, 1985).

This research was carried out into two stages. The first stage adopted a qualitative approach in order to elicit items of risk perception and risk reduction in particular for food safety related risk for the subsequent survey. The second stage was conducted as a quantitative approach to achieve the objectives of the study (Section 1.2). It was based on the findings from the literature review and the variables drawn from the qualitative study in order to confirm the relationship between consumer risk perception and purchase likelihood with respect either to risk characteristics or risk reduction. Owing to time and resources constraints, this study adopts a cross sectional survey in order to get a snapshot of an on going situation (Lo, 1998).

3.5 Qualitative Study

This qualitative approach intended to gain an understanding of consumer perception of food risk and how this may affect their actions (Ali, 1997), though it did not give any measurement. Correspondingly, only a small number of respondents were involved to provide descriptive information about their thoughts and feelings that are not easily projected to the whole population (Dillon Madden and Firtle, 1994). Nevertheless, this qualitative approach provided a framework for the subsequent survey (Kerlinger, 1986; McDaniel and Gates, 1993).

3.5.1 Study Design

Informal face-to-face interviews with 28 respondents using convenience sampling methods were adopted for this stage of the enquiry since this interviewing method is particularly useful for studying consumer attitude and personal experience, and avoiding the influence by others which can occur with other methods such as focus group interview (Calder 1994; Dillion, et al., 1994). New ideas on the study topic were also provided by the respondents through the interview (Casley and Kumar, 1992).

This qualitative approach focused on three research questions designed as below for identifying the type of risk in chicken meat that causes most concern, consumer perception of these risks and how they may adopt risk reducing strategies. They were:

- What type of food risk in chicken meat product causes most concern among the consumers?
- How do concerns about food safety affect consumer risk perception of the safety of chicken meat?
- What are the possible risk reducing strategies used by consumers during a period when there is concern about food risk?

In order to obtain an understanding of the feelings, attitudes and motivations of consumers with respect to the study topic, a systematic approach was followed. Interviews were carried out according to the guidelines of four parameters - the setting, the actors, the events and the process for the data collection suggested by Miles and Huberman (1984). Respondents were interviewed in a natural setting such as canteen, beach and holiday parks while they were eating or had just finished lunch or a snack. This made it easier for them to associate with food safety issues and provide time for a lengthy interview in a relevant environment. People were asked whether they eat or have eaten chicken meat for qualifying the informal interview.

3.5.2 Data Collection

To facilitate the process of the interview, the researcher introduced herself initially and briefly explained the purpose of the interview before carrying out each interview. It was emphasised that the interviewer was interested in the view of the respondent as a consumer. It was explained that the study was for the purpose of academic research.

Respondents were asked to identify which recent food scares (with prompts, such as *Salmonella*, *Campylobacter*, *E. Coli*, GM food, antibiotics, and nutritional imbalance) that had occurred in chicken meat that concerned them most, together with reasons. These responses were recorded for each respondent. Following the response from the first question, respondents were asked about the possible consequent losses (in particular physical, time, finance, social, psychological or performance loss) if they were exposed to the food hazard and the method they would use to reduce the risk using prompts listed from the literature (see Table 2.3). The resulting response was similarly probed. Respondents were further asked to explain why and how the consequent losses would affect them, and to give reasons for choosing particular methods to reduce the risk and explain their usefulness. Flash cards with definitions of possible food hazards, consequent losses and risk reducing strategies were used to make questions clearer to respondents and therefore easier to answer (Creswell, 1994).

The researcher acted as a facilitator to draw as much information as possible from them without imposing any influence on their responses during the interview (Dillon, et al., 1994). Though it is helpful with the aid of tape recording during the interview, some of respondents asked not to be tape-recorded. Instead, the researcher took notes of key points during the interview in order not to jeopardise the qualitative study (Hughes, 1996). To minimise researcher's miscomprehension of data collected, respondents were asked to clarify the actual meaning or requested to write down their ideas in the researcher's note pad if there was ambiguity about the answers (Blaxter, Hughes and Tight, 1997). The researcher thanked the respondent at the end of the interview. Each interview lasted for about 30 minutes.

The non-verbal behaviour of the respondents such as a nodded head or shaken fingers was also noted for this could help in interpreting the interview data (Casley and Kumar, 1992). Quotation marks were used to record respondents' verbal and written responses. Summaries of the interview including the setting, the respondent's non-verbal behaviour, credibility and knowledgeability were then prepared for each respondent. Samples of records for the interviews are shown in Appendix 48.

3.5.3 Data Analysis

The number of times for each particular food hazard was counted and ranked in descending order of frequency. For the perceived consequent losses and risk reducing strategies, pre-determined categories such as physical loss, time loss for perceived risk and brand, quality assurance for risk reducing strategies were prepared separately according to the literature (Blaxter, Hughes and Tight, 1997). These categories helped to retrieve and code the data easily, but these pre-determined categories were not fixed and subject to modification (Fielding, 1993).

Before analysing the data, a search for common statements about relationships among categories of perceived consequent losses and risk reducing strategies was carried out. This helped to interpret the mass of collected data (Chisnall, 1992). The statements were then grouped together after exploring and comparing the contrary or alternative explanations of the findings since the process of data analysis is eclectic and there is no “right way” or “wrong way” (Tesch, 1990). Based on similarities and dissimilarities, categories were modified for making comparisons and contrasts in order to reduce the data and interpretation by the process of qualitative analysis (Marshall and Rossman, 1999).

A code was then given to each category. Codes in the form of abbreviations of key words were put alongside the statement. The generation/modification of coding and categories was carried out simultaneously when new ideas emerged. The meanings of the data were explored and evaluated to check for any plausible meaning and linkage among them throughout the process. This helped to determine how useful the statements in explaining consumer risk perception and the risk reducing strategies. New and modified categories for perceived loss and risk reducing strategies were created from this process. The final categories were ensured to be internally consistent but distinct from one another as the guidelines specify that they should have the same theme within categories (Marshall and Rossman, 1999). For conformity of the interpretation, the analysis has been verified independently by a second researcher (Leininger, 1994).

The number of times for each category of perceived consequent losses and risk reducing strategies were eventually counted and ranked in descending order of frequency. The information was then prepared in matrices as suggested by Miles and Huberman (1984) showing the relationship among categories. The descriptive statistics of respondents and the results of this qualitative study are presented in Chapter 4.

3.5.4 Limitation of Qualitative Study

The purpose of this qualitative study was not for drawing theoretical conclusions, but to elicit key issues, concepts and vocabulary relevant to the context of food safety related risk. The study adopted a convenience sampling approach. The choice of the interviewing method might have resulted in interviewer and interviewee bias.

Informal interviews of this kind may be biased by selection and interaction bias by the interview, such as prompting, assertion, or compliance-seeking bias. They can also be biased by, for example, strategic bias on the part of the interviewees, including in some cases a wish to please the interviewer. The analysis and interpretation of data were carried out with care in order to avoid these potential sources of biases. The qualitative study was designed to develop the questionnaire of the subsequent quantitative survey. As a result, all key issues, concepts emerged from the data analysis were adopted to form part of the input for the questionnaire design in the quantitative survey. A quantitative study is therefore required to confirm the findings from this qualitative approach.

3.6 Quantitative Study

This quantitative approach intended to measure the impact of food risk characteristics or risk reduction on consumer perception of consequent loss, and subsequent purchase behaviour in order to build two consumer food purchase models in relation to food safety related risk. This approach involved collecting and analysing numerical data and applying statistical techniques. Because of involving a relatively large number of respondents, data collected by such survey method provides a quantitative or numeric description (Fowler 1988). The extensive data makes the prediction possible and confirmed by observations.

Correspondingly, this approach provides an insight of how consumers risk perception influences consumer purchase behaviour. It also explores how the former links with either food risk characteristics or risk reduction with respect to food safety related risk.

3.6.1 Sampling Design

Quota sampling was adopted to reflect the true characteristics of the population since this sampling method succeeded in providing respondents who varied greatly in personal characteristics. Specific numbers of respondents, who possess certain characteristics known or presumed to affect, were selected in order to ensure that the proportion of the sample elements possessing a certain characteristics was approximately the same as the proportion with the characteristics in the population of interest. (Dillon, et al., 1994). This non-probability sampling method could provide evidence of the impact of risk reducing strategies on purchase likelihood if consumer perceived risk is reduced, though the inference of result from this study is limited. A further study using probability-sampling method of a larger sample is suggested.

Following the common practice in commercial market research, quotas were created on the basis of age groups, for which information was available and believed to reflect the true characteristics of population (Dillon, et al., 1994; Lynn, 1996). Past research shows that age plays a role in meat purchase decisions (e.g. Burton, Tomlinson and Young, 1993; Mainland, 1998). Older people tend to be more cautious than younger people (Kogan and Wallach, 1964). The defined population was first divided into mutually exclusive and collectively exhaustive groups, call strata. Each strata was then formed such that the homogeneity of the sampling elements within quota was maximised (Dillon, et al., 1994). This relatively limited sample within each quota gives a generally precise estimate of the stratum mean.

3.6.2 Quota Size

The sample size of each quota followed the ratio of the number of population elements by quota. Following the recommendations of Dillon et al. (1994), the numbers of quota were decided in terms of cost and precision that were adequate for statistical analysis. Conditions for decision were followed:

- The availability of information of classification variables,
- Their correlation with the principal survey characteristics of interest,
- Cost of defining the quota, and
- Cost of allocating the population elements for each quota.

Individuals with age between 16 and 70 were taken into consideration of their comprehension of the questionnaire and their responsibility of food purchase (Casley and Kumar, 1992; Mitchell and Boustani, 1994). Consequently, three age groups were selected from Annual Abstract of Statistics, 2000. They are

- 16 - 34 years of age, 38% of total population.
- 35 - 54 years of age, 40% of total population.
- 55 - 70 years of age, 22% of total population.

A total of 200 individuals was selected following the guideline of LISREL analysis that the sample size needs to be greater than 150 in order to have parameter estimates with standard errors small enough to be of practical use (Nielson, 1998). Samples were collected at the same proportion with the characteristic in the population in order to reflect the whole population. The number of each quota for the three age groups was:

- 16 - 34 years of age: 76 samples.
- 35 - 54 years of age: 80 samples.
- 55 - 70 years of age: 44 samples.

3.6.3 Instrument Development

The research was conducted by using a self-administrative questionnaire (Appendix 47). The items were derived from past literature, trade journals and press in food safety, and measure scales were adopted and modified from past research in order to provide reliability and validity (Stone, 1978). In addition, multi-items were used to increase the scale sensitivity (Churchill, 1979).

Items of risk characteristics shown in Table 3.1 were modified from the work of Sparks and Shepherd (1994a) and Miles (1999b) by excluding those items not related to microbiological hazards, such as benefits associated with the hazards, and benefits are received by those at risk. Moreover, suggestions from food industry were included, such as adequate enforcement, and activist influence. They were phrased as statements on a seven-point Likert-like scale, anchored at the ends with the term 'strongly disagree' and 'strongly agree'. Twenty-five measurement items for food risk characteristics are presented in Table 3.1.

Table 3.1 Measurement Items[a] for Food Risk Characteristics

ITEMS	EXPLANATION
	(Anchors: Strongly Disagree / Strongly Agree)
KNOWLEDG	Knowledge of microbiological hazards
IMPACT	Awareness of impact of hazards
CONSEQUE	Concerned about the consequence
INFO	Incomplete information about microbiological hazards
SAFETY	Concerned about the safety
MEDIA	Media exaggerates the consequence of microbiological hazards
SCIENCE	Known to scientists
COOKINST	Prevented by observing cooking instructions
WELLCOOK	Reduced by thorough cooking
REGULAT	Controlled by regulation
ADEQ.REG	Controlled by adequate regulations
ENFORCE	Controlled by adequate enforcement
GOV.AGEN	Top of government agenda
ACTIVIST	Activists can exert influences to reduce risk
PRODUCER	Prevented by food producers
VOLUNTAR	Choose not to buy chicken with Salmonella
H.INFO	Real risks are hidden from consumers
FUTURE	Adverse effect on future generation
ENVIRON	Adverse effect on environment
SPREAD	Effects are widespread across UK
S.QUICK	Adverse effects can spread quickly
CONTRO.E	Cannot control easily
CONTRO.Q	Cannot control quickly
INCREASE	Becoming more serious
PEO.RISK	People in general are at risk

Risk perception was measured in terms of multi-dimensions of perceived consequent loss. The items shown in Table 3.2 were adapted from the studies of Roselius (1971), Mitchell (1994) and the qualitative study. They were phrased as statements on a seven-

[a] All measures employ 7-points Likert-like scale

point Likert-like scale, anchored at the ends with the term 'very unlikely' and 'very likely' for the probability of risk occurrence, and 'not at all' and 'very much' for the seriousness of risk occurrence. An additive model was adopted to combine the probability of occurrence and the seriousness of occurrence with equal weighting which was justified because by observation the respondents have adjusted the scores and weighted heavily on the seriousness of occurrence. Ten measurement items for perceived consequent loss are presented in Table 3.2.

Table 3.2 Measurement Items[a] for Perceived Consequent Loss

Items	Explanation
	(Anchors: Occurrence – Very Unlikely / Very Likely *Serious Loss – Not at all / Very Much)*
L.SICK	Sick
L.HEALTH	Adverse effect on health
LONGTERM	Adverse effect on health for long term
L.MONEY	Money wasted
L.INCOME	Lose income/job
L.TIME	Time lost
L.SOCIAL	Let down or embarrassed among friends/family
L.PSYCHO	Get cross or upset
L.LIFEST	Adverse effect on lifestyle
L.TASTE	Adverse effect on the taste

Following the suggestion of Morgan and Hunt (1994), a single item was used for measures of self-reported intentions to perform specific behaviour. By adopting their measurement scale, purchase likelihood was measured by a weighted average of immediate purchase, purchase after 1 month, 3 months and 6 months on the seven-point Likert-like scale. They were anchored at the ends with the terms 'very unlikely' and 'very likely'. Four measurement items for purchase likelihood are presented in Table 3.3.

[a] All measures employ 7-points Likert-like scale

Table 3.3 Measurement Items[a] for Purchase Likelihood

Items	Explanation
	(Anchors: Strongly Disagree / Strongly Agree)
PURCHLI[b]	(1) Continue to purchase (2) Purchase after 1 month (3) Purchase after 3 months (4) Purchase after 6 months

The items to measure risk reducing strategies were adapted from the studies of Roselius (1971), Mitchell and Greatorex (1990). The findings from the qualitative study were also included such as traced to original source, inspecting product before purchase, keeping meat in fridge/freeze after purchase, separating meat from other products. They were phrased as statements on a seven-point Likert-like scale, anchored at the ends with the term 'very unlikely' and 'very likely'. Seventeen measurement items for risk reduction are presented in Table 3.4.

Table 3.4 Measurement Items[a] for Risk Reduction

Items	Explanation
	(Anchors: Strongly Disagree / Strongly Agree)
LOYALTY	Purchase the same brand
W.BRAND	Choose a well-known brand
MON.BACK	Choose product with some form of money back guarantee
QUALITY	Choose product with quality assurance
GOV.LAB	Tested by government laboratory
PRIV.LAB	Tested by private laboratory
TRACEAB	Traced to the original producer
PRI.RED	Purchase product with price reduction
ORGANIC	Purchase free range chicken
SHOPPING	Shop around for special offer

[a] All measures employ 7-points Likert-like scale
[b] The final score is a weighted average of the four items. Item (1) is weighted eight times. Item (2) is weighted four times. Item (3) is weighted two times. Item (4) is simply the score.
[a] All measures employ 7-points Likert-like scale

Table 3.4 Measurement Items for Risk Reduction

Items	Explanation
	(Anchors: Strongly Disagree / Strongly Agree)
AVAILABL	Available in all major supermarkets
ADVICE	Recommendation from family/friend
GUIDES	Reading consumer guide
LEAFLET	Reading in-store leaflet
SELFINSP	Inspecting product before purchase
KEEPCOLD	Keeping meat in fridge/freeze after purchase
SEPARATE	Separating meat from other products

Preliminary versions of the questionnaire were pre-tested with 15 respondents from a variety of people in terms of age in order to test the wording of items and to ensure the practicability of the questionnaire (Dennis and Valacich, 2001). Respondents were asked to complete the questionnaire, encouraged to identify unclear items, comment on the order of questions, and suggest changes. Pre-testing phrase was complete when the last two respondents did not recommend any significant changes (Sethi and King, 1994). The questionnaire was then refined and finalised to improve the content validity.

3.6.4 Data Collection

Using an intercept survey technique, data were collected on different days of the week and different time of the day to avoid the potential for over-representing of personal characteristics of respondents, other than age group which was the selection criteria. In order to improve the quality of quota samples, the survey was carried out in various locations such as park, beach to allow more interview time (Dillon, et al., 1994). Different time segments and various locations were adopted to minimise selection biases and interviewer's preference until the number of samples in each quota was achieved (Casley and Kumar, 1992). A record of the schedule for the quantitative survey is shown in Appendix 15.

Similar to the procedure conducted in the qualitative study, the researcher introduced herself and asked those who ate or have eaten chicken meat to participate. It was emphasised that the interview was a part of an academic project. The respondents were given a set of questionnaire shown in Appendix 47 and a pen. They were reminded that the questionnaire focused on microbiological hazards in chicken meat and it was not testing their knowledge but interested in their views as a consumer. Therefore there were no right or wrong answers. They were told to read carefully about the definition of the microbiological hazards on the front page and to refer to it throughout the answering process. To minimise any influence from the researcher, the respondents were asked to answer the self-administrative questionnaire at their own pace without the immediate presence of the researcher. The researcher later collected the questionnaire and checked for any missing answers. Respondents were finally thanked with a complimentary pen after they completed the whole questionnaire. The data were then entered into SPSS and LISREL 8.30 for data analysis after the numbers of each quota were achieved.

3.6.5 Data Purification Using Principal Components Analysis

Exploratory factor analysis was adopted to purify the items and determine the number of factors. Prior to obtaining meaningful results, the data was screened for multicollinearity (variables that are very highly correlated) and singularity (variables that are perfectly correlated) using the correlation matrix (Field, 2000). Criteria for data screening are shown in Appendix 1. The correlation matrix in Appendix 2 and Appendix 30 was checked for values in excess of 0.99 which are causing problems to determine the unique contribution to a factor. Since there was no value of correlation exceeded 0.99, all items were retained. Subsequently, 25 items for food risk characteristics and 17 items for risk reduction were "factor-analysed" by using a maximum likelihood extraction method after the data screening (Table 3.1 and Table 3.4). Using SPSS, the set of observed items for the 200 valid cases was submitted to Principal Components Analysis (PCA) to summarise them into a small number of factors to facilitate the analysis in a later stage using Structural Equation Model.

Two methods namely Kaiser's criterion and scree test are commonly used to determine the number of factors of risk characteristics and risk reduction. Following

Kaiser’s Criterion, only factors with an eigenvalue greater than 1 were chosen (Kaiser, 1960). In other words, the factors chosen explain variances at least as good as any one of their underlying item (Iacobucci, 1994). The Kaiser's criterion is considered reliable when the number of items lies between 20 and 50 (Mitchell, 1994). According to the scree test, factors before the first turning point in the eigenvalues curve against number of factors were retained (Cattell, 1966). The scree test is sometimes not reliable because the eigenvalue curve often shows a single very large eigenvalue and then a nearly linear decline thereafter (Iacobucci, 1994). The method which provided higher explained variance and more valid items was chosen for this study.

Rotation of the factors was performed to improve the interpretability (Kerlinger, 1986). Varimax rotation, which maximises the variance of the loading within factors across items, was adopted to maximise the spread of factor loading. That is, loadings that are high after extraction become higher after rotation and loadings that are low become lower.

Measurement items with loading greater than 0.63 were initially included in the model and put through LISREL 8.30 for data analysis. The model however did not converge. The model was rerun by removing the measurement items one by one in ascending order of their factor loading until the model converged. All items contained in this model were found to have minimum factor loading of 0.71.

3.6.6 Justification of Structural Equation Modelling

PCA does identify the underlying factors of risk characteristics, risk perception and purchase likelihood, but does not show their relationships. A technique was needed for this purpose. Multiple regression is commonly used to identify the relationship between dependent variable and independent variables as a whole (Maruyama, 1997).

But, the use of multiple regression could not achieve the objectives of the present study. Firstly, multiple regression is incapable of handling latent variables such as risk characteristics. Secondly, multiple regression cannot be used with the presence of a mediating variable(s), such as perceived risk. Thirdly, multiple regression cannot estimate dependent variables measured by multi-items, such as perceived risk. Multiple regression was therefore considered to be an inappropriate method for analysing the data in the context of linking food risk characteristics, risk reduction, risk perception and purchase likelihood. As an alternative, Structural Equation Modelling (SEM) was selected for data analysis and the development of the proposed model of consumer risk perception and purchase behaviour.

SEM has evolved from regression techniques and builds on the assumptions of regression, and can simultaneously predict and explain relationships. The assumptions of SEM are shown in Appendix 3. It also merges the logic of multiple regression and path analysis with a single analytical framework and therefore can cater for the presence of a mediating variable between exogenous (independent) variables and endogenous (dependent) variables (Bentler, 1980; Cheng, 2001). Furthermore, the causal effects of individual exogenous variables can be determined. This includes a combination of direct and indirect effects: the direct effect from the exogenous variables onto the endogenous variable, such as direct effects of risk characteristics on risk perception and the indirect effect from the exogenous variables onto the endogenous variable through mediating variable(s), such as indirect effects of risk characteristics on purchase likelihood through risk perception (Hoyle, 1995).

SEM has been widely used in consumer behaviour (Laroche, Kim and Tomink, 1999), management (Van Vianen, 1999), service marketing (Caruana, Pitt and Berthon, 1999; Babakus, Cravens, Johnston and Moncrief, 1999), relationship marketing (Nielson, 1996 and 1998), banking services (Heaney and Goldsmith, 1999), human resources (Elangovan, 2001), supply chain management (Tracey and Tan, 2001). Researchers have often used SEM to examine the possible relationships among factors simultaneously and to address complicated managerial and behavioural issues (Cheng, 2001).

Because the consumer food purchase model consisted of risk perception as a mediator between risk characteristics or risk reduction (the exogenous variables) and purchase likelihood (the endogenous variable), SEM was justified for this study to analyse the link of food risk characteristics, risk reduction, risk perception and purchase likelihood. The technique can estimate the causal effect of risk characteristics and risk reduction on risk perception and purchase likelihood. SEM can provide the prediction of purchase likelihood from causal factors. SEM was therefore chosen for this study.

3.6.7 Data Analysis Using Structural Equation Modelling

The factors identified from PCA formed the latent variables which were then analysed by Structural Equation Modelling. LISREL 8.30, a specific statistical software package was applied to identify the relationship between food risk characteristics, risk reduction, risk perception and purchase likelihood. Testing observed items poses a difficulty for the conceptual consumer food purchase model in this study since estimation is limited by the fact that the size of the asymptotic covariance matrix needed for estimation increases rapidly with the number of items in the model (Bagozzi and Baumgartner, 1994; Diamantopoulos and Siguaw, 2000).

There were 53 observed items including 25 items for risk characteristics, 17 items for risk reduction, 10 items for risk perception and 1 item for purchase likelihood. A sample size of over 1,000 respondents is required for data analysis with this number of variables (Joreskog and Sorbom, 1999). Nevertheless, given the exploratory nature of the study, it was considered worthwhile to proceed with SEM even though resources mere only available to recruit a total of 200 quota samples. To overcome this difficulty, the methodology which was used by Daily and Johnson (1997) to address constraints imposed by sample size was adopted. The conceptual consumer food purchase model was broken into two individual models in relation to risk characteristics (Figure 3.2) and risk reduction (Figure 3.3) rather than a single comprehensive model. The first model relating to risk characteristics was developed to achieve the first two objectives of the research. This helps to identify the risk characteristics that affect consumer risk perception and to determine the effects of risk characteristics on consumer risk perception and purchase likelihood. The second model relating to risk reduction was developed to achieve the remaining objective. This helps to identify the risk reducing strategies that modify consumer risk perception and the effect of the latter thereafter on purchase likelihood, assuming constant effects from risk characteristics on consumer risk perception. Attempts to combine the two models into one were made at the final stage by selecting those significant items from the two models. However, all factors in the first model were significant, in other words, no non-relevant items were eliminated from the first model. Though two of the factors in the second model were eliminated, the number of remaining items of both models was still large for the purpose intended. Therefore, a combined analysis could not be performed by LISREL 8.30 because of insufficient sample size.

In addition to extensive review of literature on this issue (e.g. Pang, 1996; Daily and Johnson 1997; Marongiu and Ekehammar, 1999; Chae and Hill, 2000), advice was sought on the validity of the approach from Slovic, and Daily (personal communication). Daily advised, on the basis of similar experience she had encountered that guidance given in Joreskog and Sorbom should be followed. This was done.

Figure 3.2 Consumer Purchase Model Linking with Risk Characteristic

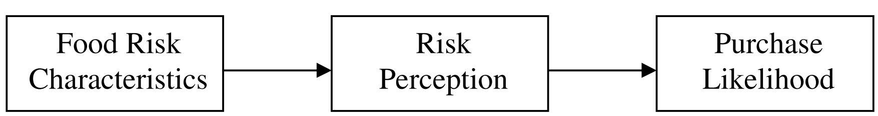
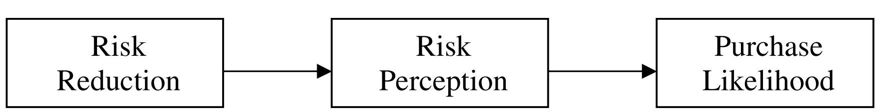


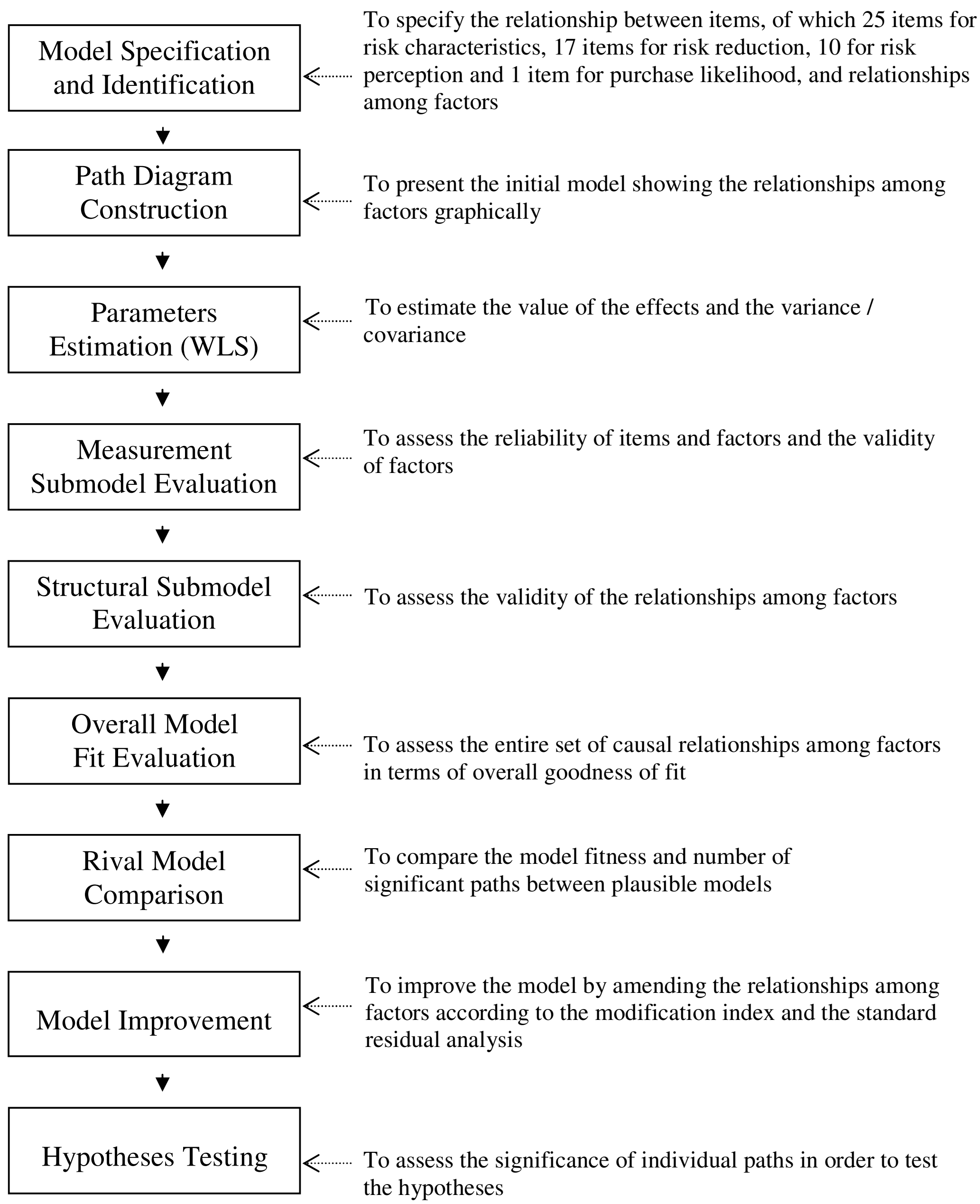
Figure 3.3 Consumer Purchase Model Linking with Risk Reduction



3.6.7.1 Procedural Flow Diagram of SEM

After carrying out PCA for data purification, the procedure for data analysis using SEM is illustrated in Figure 3.4. The elements of the procedure are discussed in turn in the following sections.

Figure 3.4 Procedural Flow Diagram of SEM



3.6.7.2 Model Specification and Identification in SEM

The two consumer food purchase models were specified in order to identify the relationships among factors / items (Hoyle, 1995). A set of parameters was formulated in terms of fixed or free parameters. The parameters were fixed to zero if there was no relationships between factors / items. On the other hand, the parameters were free if the relationships existed. Basically, SEM is divided into two submodels: the measurement submodel (Appendix 4) and structural submodel (Appendix 5). The former relates the observed items to latent variables and the latter inter-relates the latent variables (Marconlides & Hershberger, 1997). Measurement submodel and structural submodel were defined by the pattern of fixed and free parameters in SEM.

The condition for identification of the two models was tested to ensure a single, unique value for each and every free parameter could be obtained from the observed data. The condition was satisfied if the number of free parameters estimated did not exceed half of the number of distinct elements in the variance-covariance matrix of the observed items (Hoyle, 1995; Diamantopoulos and Siguaw, 2000).

3.6.7.3 Path Diagram Construction

Two proposed path diagrams were constructed after developing the set of causal relationships from the previous section. A sample path diagram is shown in Appendix 6. Risk characteristics or risk reduction acted as exogenous variables and was measured by observed items. Risk perception was then proposed to be the sole predictor of purchase likelihood, which was measured by the weighted average of the observed items. The path diagrams were then converted into measurement and structural submodel equations following the standard format presented in Appendix 7.

3.6.7.4 Parameter Estimation

After constructing the path diagram, an iterative method was used to obtain an estimate of the free parameters from the observed data so that the estimated covariance matrix was similar to the observed one (Hoyle, 1995). Since the scales were ordinal, this study adopted the Generally Weighted Least Squares method (WLS), which has the advantage of obtaining the estimates of parameter regardless of the form of the distribution underlying the observed items.

3.6.7.5 Measurement Submodel Evaluation

By adopting a two-step approach, a separate estimation of the measurement submodel was assessed prior to the estimation of the structural submodel (Anderson and Gerbing, 1988). The measurement submodel was assessed in terms of its reliability and validity since the existence of significant relationships among the theoretical factors can only be demonstrated by a satisfactory level of validity and reliability in the measurement submodel (Dillon and Goldstein, 1984).

<u>Assessing Reliability</u>. Multi-items were used in this study to improve the scale sensitivity. These items reflected to some extent to the variance of the intended factor and to some extent to the random error. Reliability of items was then assessed to see if these items were reliable when they reflected mostly the variance of the factor. In other words, internal consistency of the factor was ensured. Reliability of measurement submodel was measured by item reliability, Cronbach alpha and factor reliability. Item reliability was evaluated to ensure the adequate measurement of a factor by given items (Bagozzi and Baumgartner, 1994). Correspondingly, Cronbach alpha and factor reliability were checked for the consistence of the factor to ensure the variance captured by the factor is more than by the error component (Hair, Anderson, Tatham and Black, 1992). The formulae and the guidelines for the evaluation of item reliability, Cronbach alpha and factor reliability are shown in Appendix 8.

<u>Assessing Validity</u>. Factor validity was tested to ensure that a factor measures the concept that it is supposed to measure (Bagozzi, 1994). Without an acceptable factor validity, the result of the study may be ambiguous. That is, hypotheses might be accepted or rejected because of excessive error in measurement, not necessary because of the adequacy or inadequacy of theory. Validity of the factors was tested by

convergent validity, discriminant validity and average variance extracted. The guidelines for these tests are shown in Appendix 9.

3.6.7.6 Structural Submodel Evaluation

The validity of structural submodel was assessed by the total coefficient of determination in order to test the joint strength of relationships in the structural equations and the predictive power of the structural submodel. Sethi and King (1994) cite that "the conceptual meaning of a factor is determined not only by its definition and operationalization (Bagozzi, 1981) but also by its relationships to causal factors and its consequence (Bagozzi and Fornell, 1982). The formula of total coefficient of determination is shown in Appendix 10. The coefficient lies between 0 and 1, and large values being associated with good validity (Dillon and Goldstein, 1984)

3.6.7.7 Overall Model Fit Evaluation

The overall model fit was assessed to ensure that the model was an adequate representation of the entire set of causal relationships. Model fit determines the degree to which the structural equation model fits the sample data. Thus, statistical tests of the model were used by testing the difference between the variance/covariance matrix predicted by the model and the sample variance/covariance matrix from the observed data (Maruyama, 1997). There are three ways to assessing the overall model fit, namely absolute fit, comparative fit and parsimonious fit.

<u>Absolute Fit</u>. Absolute fit of the model was tested by Chi-square (χ^2), Goodness-of-fit index (GFI), Adjusted goodness-of-fit index (AGFI), Root mean squared error of approximation (RMSEA), Non-normed fit index (NNFI), and Non-normed fit index (NNFI) for assessing the ability of the model to reproduce the actual covariance matrix. The definition of these indices is shown in Appendix 11.

<u>Comparative Fit</u>. Comparative fit of the model was tested by Incremental fit index (IFI), Comparative fit index (CFI) and Relative fit index (RFI) for comparing two or

more competing models in order to obtain a model with a better fit. The definition of these indices is shown in Appendix 12.

Parsimonious Fit. Parsimonious fit of the model was tested by Parsimonious normed fit index (PNFI) and Parsimonious goodness-of-fit index (PGFI) for comparing two or more competing models in order to achieve a specific level of fit with less number of estimated free parameters. The definition of these indices is shown in Appendix 13.

After calculating these indices, the results were checked against the guidelines summarised in Table 3.5.

Table 3.5 Guidelines of Overall Model Fit

GOF Criterion	Value Range	Acceptable Level
Absolute Fit		
Chi-square (χ^2)	Tabled χ^2 value	Compares with tabled value for given df
Goodness of fit (GFI)	0 (no fit) to 1 (perfect fit)	Value close to 0.90 reflects a good fit
Adjusted GFI (AGFI)	0 (no fit) to 1 (perfect fit)	Value > 0.90 reflects a good model fit
Root-mean-square error of approximation (RMSEA)	<0.10	<0.10 reflects good fit <0.05 reflects very good fit <0.01 reflects outstanding fit
Normed fit index (NFI)	0 (no fit) to 1 (perfect fit)	Value close to 0.90 reflects a good fit
Non-normed fit index (NNFI)	0 (no fit) no upper bound value	Value close to 0.90 reflects a good fit
Comparative Fit		
Comparative fit index (CFI)	0 (no fit) to 1 (perfect fit)	Value close to 0.90 reflects a good fit
Incremental fit index (IFI)	0 (no fit) to 1 (perfect fit)	Value close to 0.90 reflects a good fit
Relative fit index (RFI)	0 (no fit) to 1 (perfect fit)	Value close to 0.90 reflects a good fit
Parsimonious Fit		
Parsimonious goodness of fit index (PGFI)	0 (no fit) to 1 (perfect fit)	Compares values in alternative models
Parsimonious normed fit index (PNFI)	0 (no fit) to 1 (perfect fit)	Compares values in alternative models

(Source: Schumacker and Lomax, 1996)

3.6.7.8 Power Test of Close Fit

The statistical power of the model was ensured by analysing the degrees of freedom in the model and the number of observations (Diamantopoulos and Siguaw, 2000). The power estimate for the model was then compared with the guideline recommended by MacCallum, Browne and Sugawara (1996). The analysis is sufficiently powerful if the power estimate obtained is greater than 0.8 because there is greater than 80% chance that an incorrect model is rejected. The guideline is shown in Appendix 14.

3.6.7.9 Comparing Rival Model

Two rival models were developed for consumer food purchase model linking with either food risk characteristics or risk reduction for comparing with the proposed models correspondingly. The comparison helps to work out the best plausible model in order to achieve a higher level of fit through alternative explanations of a series of competing models (Breckler, 1990; Bollen and Long, 1992; Menguc, 1996).

A rival model linking with food risk characteristics was developed by adding a direct path from knowledge and own control to purchase likelihood and deleting the path to risk perception accordingly. Knowledge referred to the awareness of the microbiological hazards and the impact of the food hazard. Own control referred to controlling the food risk by following the cooking instruction and cooking well. Correspondingly, a rival model linking with risk reduction was then designed by adding a path from price discount to purchase likelihood since price reduction is often used to encourage purchases of the offending product as well as to trade off risk perception in times of food scares.

Following the guideline of choosing the best model, the overall model fit indices and the power of fit were checked to compare the rival model with the proposed model. Besides, the number of significant paths of the model was considered.

3.6.7.10 Model Improvement

The model fit could be improved by carrying out the model modification based on the modification index and standard residual analysis. Modified models were developed for consumer food purchase linking with either food risk characteristics or risk reduction. The procedures for choosing the best were the same as in Section 3.6.7.9.

3.6.7.11 Hypotheses Testing

The significance of individual paths was tested after obtaining a valid model since a good fitting model can also have insignificant parameters (Maruyama, 1997). The ratio of all estimates to its standard error distributes as a z statistic. The estimate was considered reliably different from zero if the ratio was greater than 1.96 (for 5% confidence). That is, it would be more than 95% chance of being wrong to say there is no relationship between the two factors in the hypothesis (Schumacker and Lomax, 1996).

3.7 Study Appraisal

The research issue, methods and questionnaire design were discussed in detail with the key informants from food industry and research institutes through personal interviews as the study progressed.

Two papers have been published (Yeung and Morris, 2001a; Yeung and Morris, 2001b), and others are in preparation.

3.7.1 Academic Visits

Academic visits were undertaken in order to review the work of others, to discuss progress of the study and to present advances of the research. The following visits were made:

- Department of Psychology, University of Surrey, UK. November 1999. Discussed issues: Relevance of the study. Classification of food risk and research methods.
- Nutrition and Consumer Science Division, Institute of Food Research, UK. December 1999. Discussed issue: The relationship of food risks and food risk characteristics.
- Food Safety Unit, Unilever Research Colworth, UK. March 2000. Discussed issues: Consumer perception of risk between microbiological and chemical hazards. The validity of questionnaire design. The food industry concerns.
- British Poultry Council, UK. November 2001. Discussed issues: The importance of consumer risk perception and purchase behaviour to poultry industry. The current practices and risk management strategies adopted by poultry industry.
- Meat and Livestock Commission, UK. December 2001. Discussed issues: The usefulness and applicability of the consumer food purchase models.

3.7.2 Conferences

Presentations relating to the research were given in the following conferences:

- First Postgraduate Research conference. Cranfield University, Silsoe, UK. June 28 and 29, 2000. Poster. Title: Food safety: consumer risk perception and risk reduction.
- Conference of Food Safety in Europe – Challenges and Opportunities. London, UK. October 19 and 20, 2000. Poster. Title: Food safety: consumer risk perception and risk reduction.
- Second Postgraduate Research conference. Cranfield University, Silsoe, UK. June 21 and 22, 2001. Oral presentation. Title: Food safety: consumer food purchase models.

3.7.3 Industrial Consultation

Open-ended questions were sent to 15 companies to confirm the importance of this research and to review how the poultry industry perceives and responds to consumer perception of microbiological risk in chicken meat. This helps to interpret the implications of the study for the food industry. Responses from 6 leading companies were received.

3.8 Critique of the Approach

The contribution of this study is to combine psychometric factors and the perceived risk theory applies to the context of food safety and consumer purchase behaviour. This has helped to understand the relationship between food risk characteristics, risk perception and purchase likelihood. A framework of consumer food purchase behaviour was constructed for microbiological risk in chicken meat. However, this has the potential to apply to other food risks in chicken meat and other food sectors. The framework provides estimates of the effects of individual factors on purchase likelihood. It also has the potential to help measure the effectiveness of a risk management programme by comparing the effects of the causal factors and risk perception on the purchase likelihood before and after implementing risk management plan.

This approach was using a 200 quota sample on the basis of age. Since the survey had not adopted a random sampling method, there could be bias in sample selection and responses may not necessarily be representative of attitudes in the UK as a whole. The sample size was limited by the resources available. Despite the size and non-probability sample used, it is considered that the results are likely to reflect the general attitudes of the people in the country; however generalisation of the result must be made with care.

The issue relates to the statistical technique used in this study. LISREL 8.30 is an analytical technique which can handle endogenous items measured by multi-items, with the presence of a mediator, constructed or 'latent' variables. It provides estimates for the relationships of multiple independent and multiple dependent factors. It constructs new 'latent' variables out of the observed items and identifies the relationships between these and observed measures. LISREL also provides detailed information to allow the integrity of estimates to be assessed.

But the technique, for a variety of reasons, has received limited acceptance among some research communities. This may be explained by the following. SEM merges the logic of multiple regression and path analysis within a single analytical framework. The theoretical assumptions are therefore complex. This creates a conceptual challenge to the user on how the relationships between latent variables are formed and can be assessed. As with all statistics analysis, the user is required to have a basic knowledge of multivariate analysis techniques. However, some of the routines in LISREL are complicated and the conditions for model evaluation engage sophisticated criteria which can be demanding of statistical knowledge and matrix algebra. In this respect there is perhaps less transparency in the analytical routines compared to regression analysis.

The nature of some of the literature on the use of LISREL can be rather incomprehensible. Most researchers have found that the procedural manual is difficult to follow (Diamantopoulos and Siguaw, 2000). The software package of LISREL is not user-friendly and this creates a barrier to users. In other words, the user must have a thorough understanding of the manual before carrying out the analysis. Furthermore, because of the complexity of the statistical algorithms, it is necessary to begin the use of LISREL with a conceptualised model grounded on theory, and those rules for model improvement should be closely followed. There is a risk here that LISREL may do no more than confirm prior knowledge, rather than challenge it or create new theories. It is important therefore that researchers follow the guidance on the use of LISREL to use its powers to explore, develop and test new relationships and related theory. In this respect the technique is sensitive to user motivation and skill.

Furthermore, SEM is data intensive both in terms of quality and quantity. It works best with high quality data (in terms of reliability, accuracy and scalar qualities) because stringent guidelines are set in formulating and testing model. For example, models which attempt to integrate large sets of variables and latent, constructed variables require large data sets if the derived models are to comply with the required goodness of fit criteria. Thus, the comparative versatility and flexibility of LISREL is compromised if data quantity is limited. Nevertheless, inspite of the potential disadvantages, the application of LISREL has some considerable advantages as a research tool if used with discretion and care.

3.9 Summary of the Chapter

This chapter has shown the methods used to progress the research. This involved qualitative and quantitative approaches. The qualitative approach was applied to identify the type of food safety related risk in chicken meat that causes most concern, and to elicit the items of risk perception and risk reduction. This helped to develop the questionnaire for the subsequent formal survey. The quantitative approach was adopted to confirm the relationship between consumer risk perception and purchase likelihood with respect either to risk characteristics or risk reduction. The procedure of collecting data from both approaches has been presented.

The use of LISREL 8.30 as the statistical tool for assessing the impact of the risk characteristics and risk reduction on consumer risk perception and the subsequent purchase has been described. Various techniques to assess the reliability and validity for the measurement and structural submodels have been discussed. The methods to test the hypotheses were introduced. An empirical framework for consumer food purchase with respect to food safety related risk was successfully developed and presented. Supports from key informants in the development of this study were listed. A critique of the research method has been included.

Having defined the methods, the next chapter focuses on the results from the qualitative study. This identified the main concerns of consumers in terms of types of food risk in chicken meat, and their perceived consequent losses and risk reducing strategies.

CHAPTER FOUR

4. QUALITATIVE STUDY OF CONSUMER MAIN CONCERN

This chapter illustrates the use of the qualitative approach and the procedure of face-to-face interview method for collecting and analysing the data given in Section 3.5. The findings of perceived main food risks in chicken meat product, components of perceived loss and risk reducing strategies are presented and discussed. These findings helped in developing the questionnaire design for the quantitative survey, and confirmed the relevance of and sharpened the hypotheses for the study. A summary is given at the end of this chapter.

4.1 Results and Discussion

Following the research method described in Section 3.5, face-to-face interviews took place in March and April in Bedfordshire, Northamptonshire, Buckinghamshire and Devon in the UK. Twenty-eight adult respondents, of whom 12 males and 16 females, were interviewed. Among them, 9 were in the age category 16 to 34 years, 9 were between 35 and 54, and 10 were over 55 years old. Narrative text including verbal and written responses, and matrices were presented to summarise the qualitative data from the face-to-face interviews.

4.1.1 The Main Food Risk in Chicken Meat

The food risks mentioned by the respondents were recorded and counted. The majority of the respondents (26 responses) suggested that microbiological hazards were the most serious food hazards (Table 4.1). The respondents were concerned about Salmonella because of its perceived serious consequence and harmful effects to health. This finding is consistent with a survey conducted by the Food Standards Agency (FSA) (TNS, 2001).

> *"Chicken has already . . . a high percentage of contamination . . . not enough care taken to eliminate the bugs."*
>
> *-Male, young family, Devon*

> *"Salmonella is the top risk. You can die."*
>
> *-Female, pensioner, Bedford*

Some of the respondents themselves or their friends had been sick and therefore changed their eating habits by cutting down the quantities of chicken consumption or have even stopped eating chicken products.

> *"I would probably eat chicken less often."*
>
> *-Male, pensioner, Devon*

> *"Because of disastrous effect on a person"*
>
> *-Female, young family, Devon*

Though *E Coli.* was not often associated with chicken meat, it appeared to be the second most serious perceived food hazard. This may have been due to high profile incidents in Britain in 1999 when 21 pensioners died as a consequence of eating infected meat. There had also been a local incident of food poisoning in Devon in 1999 to which some respondents referred.

> *"E. Coli. . . . active bacteria causes poisoning even death."*
>
> *-Female, middle age, Devon*

The feeding of GM crops to chickens was the third most important topic of concern (17 responses) even the practice is currently banned. It may be due to the uncertain consequences perceived in people's mind.

> *"GM crops haven't proven safe to eat . . ."*
> *-Female, young family, Devon*

> *"Long term effects of GM foods."*
> *-Male, young family, Devon*

Less than half of the respondents (12 responses) expressed concern about the potential consequences for human health of antibiotics fed to chickens possibly due to relatively little media coverage.

> "Antibiotic may have possible health effects, but not that worrying at present."
> -Female, middle age, Devon

Only a few respondents (6 responses) were concerned about the "nutritional imbalance" of chicken meat, since chicken meat was considered to be comparatively healthy, especially for some if they remove the skin before cooking. The result of this section is summarised in Table 4.1.

Table 4.1 Sources of Perceived Main Food Risk in Chicken Meat

Food Risk	**Number of Repetition**
Salmonella	26
E. Coli	18
GM crops fed to chicken	17
Antibiotic	12
Nutritional imbalance	6

4.1.2 Perceived Consequent Losses Associated with Food Safety Risk in Chicken Meat

Perception of losses seemed to fall into two main groups of interrelated factors: one relatively highly scored group affecting welfare and quality of life, namely health, financial circumstances, time and lifestyle, and one relatively lowly scored group affecting personal satisfaction with the product itself, namely taste, social and psychological losses.

It appears that health loss (28 responses) was the top concern among all respondents (Table 4.2). Answers on this were uniform: health loss was perceived as a fundamental impact, which affects all other consequent losses. In this respect, they described food hazards in terms of responses such as "serious", "dangerous to health", "sick", "end up in hospital", and "can die".

> *"Severe health problems . . . sometimes death."*
>
> *-Female, postgraduate student, Silsoe*

> *"First, health problems . . . loss of work leading to financial difficulties . . . Effects on young children and aged . . . sick for at least two weeks."*
>
> *-Female, middle age, Devon*

> *"Health is the fundamental problem and the others are entangled together."*
>
> *-Male, undergraduate student, Flitwick*

Regarding financial and time losses (24 and 22 responses respectively), respondents mentioned "wasting money", "no salary for sick leave", "losing job due to ill health", and "lost job leads to financial difficulties". Time loss was referred to as "can't afford to be absent from college" or "ill for a few days". Financial and time losses seemed to be closely correlated, evident in statements such as "need to seek compensation (for time off work)".

"I can't take the risk to be sick and absent from the college."
-Male, student, Flitwick

"If I were ill, I could not work and would not have money!"
-Male, middle age, Devon

"Loss of earnings . . . extra costs for babysitting if sick."
-Female, young family, Devon

Lifestyle losses were also relatively important (20 responses). This was captured in terms of statements such as "can't go out", "restricted diet" and "not much fun". Some respondents were particularly concerned that lifestyle losses would be the result of ill health due to contaminated food. They considered that the worst case was to be "house-bound", on a "restricted diet" or required to "give up" some valued activities because of long-term "health problems".

"Restrict lifestyle or social life as I am debilitated."
-Male, young age, Devon

"I may have to miss weekly activities like the 10-pin bowling league team."
-Female, young family, Devon

Performance loss in the form of reduced quality of taste was referred to by 14 respondents. Some respondents suggested that the taste of chicken meat was greatly reduced due to the need to overcook chicken because of the risk of bacteria. They said that chicken meat overcooked was "tasteless", "flat", "of reduced flavour". The statement of "I don't like the taste of chicken nowadays" suggesting perceived deterioration over time. Some respondents, however, considered that food safety was more important than the taste, although others said they preferred other meat rather than chicken without taste.

> *"The intensive farming methods make the sale of chickens prematurely [i.e. not fully grown] to avoid disease risk, I don't like the taste of chicken nowadays."*
>
> *-Male, older generation, Bedford*

> *"I definitely overcook the chicken. . . . Do you find taste from an overcooked chicken?"*
>
> *-Female, middle age, Sharnbrook*

For the social and psychological loss (both 10 responses), more people were concerned about feeling "embarrassed" in front of family and friends than worried by the fact that they might be about the adverse effect of the spoiled food to them. Most of them did not consider these losses would have great implication for food safety reasons. Many respondents agreed that they might get cross and feel upset if they purchased a contaminated chicken.

> *"I really get cross if the chicken is spoiled before I feel worried about the adverse effect to the health of my family."*
>
> *-Female, middle age, Rushden*

> *"I will feel upset if I buy a spoiled chicken."*
>
> *-Female, young family, Sharnbrook*

These findings are consistent with those evident in the research literature, although the exploratory survey points to the importance of lifestyle as a separate factor. The social and psychological loss seemed to be less important in the case of chicken meat products compared to other types of purchases. But this would need to be explored further, distinguishing between food purchases made for different purposes, whether social occasions, feeding oneself or feeding one's dependants. A summary of the results of this section is presented in Table 4.2.

Table 4.2 Types of Consequent Loss Associated with Food Safety Risk in Chicken

Consequent Loss	Number of Repetition	Examples
Health loss	28	Negative health impacts, sickness, ill-health, dietary complications, damage to physiological/psychological functions, and well-being, morbidity, mortality factors.
Financial loss	24	Income losses, medical costs, product replacement costs, defensive expenditures.
Time loss	22	Commitment of additional personal time, effort in repurchasing and time loss due to illness, reduced convenience.
Lifestyle loss	20	Loss of freedoms with respect to consumption and other habits due to short term or long term impacts of food hazards (associated with health, financial, and time losses).
Product performance loss	14	Loss of product performance, such as taste, nutrition value, amount of waste, value for money.
Social loss	10	Social embarrassment associated with poor food choice, especially if the food product is contaminated, and there are negative impacts on others.
Psychological loss	10	Cross or upset associated with fear of or actual exposure to food safety risk, and the need to take risk avoidance measures.

4.1.3 Risk Reduction Adopted in Chicken Purchase Associated with Food Safety

The classification of responses regarding risk reducing strategies produced five main categories (Table 4.3), in the order of relative importance namely ‘product quality’, ‘product information (Promotion)’, ‘post-purchase control’, ‘place of purchase’, and ‘product price’.

4.1.3.1 Product Quality

Assurance provided on product quality was mentioned by 24 out of 28 respondents. More than half of these would like to see either a “quality mark” or some indication of “where the chicken came from”. Others said that they preferred to buy a well known brand, an organic product or a free-range chicken. Some also mentioned the importance of “government testing” or “private testing” of the product although some admitted that they were not sure what was being tested and how to interpret the results of tests. Some respondents were sceptical about the reliability of organic products in terms of quality and safety, which again pointed to the perceived need for a verifiable process of quality assurance.

> *“Quality assurance following scientific testing to prove its quality.”*
>
> *-Male, young age, Milton Keynes*

> *“A quality mark can be very useful if it is supported by reliable supervision and backed by guarantee.”*
>
> *-Male, older family, Maulden*

> *"I would want to know how the animals are raised, such as free range . . . I would also want to know which country as standards vary widely."*
>
> *-Female, with children, Sharnbrook*

Those consumers seeking peace of mind (avoiding psychological losses) preferred food with the proof of quality assurance. They felt that a quality mark that allowed the food to be traced from its source and that as far as possible ensured that that is free from food hazard was required. They felt that this was the case when they purchased a well-known product brand.

> *"I am very careful about the type of food product I buy and the conditions under which they are kept and sold and prepared. I would be pleased to see a quality mark on food and it would encourage me to buy, especially meat."*
>
> *-Female, older family, Rushden*

4.1.3.2 Product Information

Regarding product information, 23 respondents called for more product information so that they could know where the food comes from and how it is produced and processed. They also sought information on guidelines for storage and cooking as well as the "use by date". They believed that this would help them to judge and choose safe food for consumption, enabling them to store and cook the food correctly.

> *"Helps understand how it was produced, like GM free . . also storage and cooking instructions."*
>
> *-Male, middle age, Flitwick*

"Safety is always important, so there should be storage and cooking instructions. The use by date and best by date can be confusing for people."

-Female, with children, Rushden

They were also concerned about the way in which the information is communicated to them.

"Occasional documentary of meat safety practices as occurs in meat factories on TV or radio can help people to be more alert on meat safety."

-Male, student, Silsoe

Some suggested that information printed on product labels was "too small" and "too ambiguous". They would like to have clear confirmation that products conform to government regulations.

"Product information is most important, unfortunately, a lot of misleading terms are used that the consumer may not fully understand."

-Female, older family, Rushden

"More law or regulation on rearing the animals in safe and animal sensitive farms, regarding what the animals are fed with grain, but not offal, or on slaughtering . . . hygiene and cleanliness."

-Female, with kids, Flitwick

"Changing small prints to big prints."

-Male, postgraduate student, Silsoe

Some respondents said they "check the ingredients" on the label before buying the product. Not many respondents, however, read non-label product information provided by food manufacturers or store operators, because either they did not know about it or they thought that there would be some bias. Some respondents preferred to take the advice of their family or friends, although this did not mean that they followed it.

4.1.3.3 Product Price

11 referred to price as basis for risk reduction. They suggested a willingness to pay a little extra for "free range chicken" to ensure food safety. They believed that free-range chicken would be of high quality and good taste, though more expensive than "factory chickens". Price reduction or special offer tended to mean lower quality in their opinion.

> *"If a food is particularly cheap, I feel it must be of a poor standard and quality. A money-back guarantee is pointless if the food has made you ill."*
>
> *-Female, older family, Oakley*

> *"I am quite suspicious of very cheap food, feeling that quality and / or safety may have been sacrificed for low cost."*
>
> *-Female, older family, Rushden*

In contrast, two respondents chose to buy food with price reduction or special offer since they believed they could control the risks by cooking well.

> *"If the food is not up to scratch, you should get your money back."*
>
> *-Female, with children, Rushden*

"I always look for the special offer as long as I cook it longer."

-Female, postgraduate student, Silsoe

Some respondents mentioned that "money back guarantee" was a good idea. Yet, some of them said that it was not important because they did not have time to claim back the money even if the food was spoiled. To conclude, most respondents did not consider price could help to relieve the food safety risk.

"Price always enters the equation but it should not be linked with food safety."

-Male, older family, Flitwick

4.1.3.4 Place of Purchase

Referring to the place of purchase, some respondents (14 responses) preferred to purchase chicken meat from a reputable, trusted source. However, only half of the respondents considered the place of purchase to be an important factor for safety product. Some respondents like to compare products between shops.

"I shop with my own eyes."

-Male, Pensioner, Devon

All respondents said that they would prefer to buy from a reputable outlet, rather than from somewhere "unhygienic", using descriptions such as "open market", "food with no cover" and "I saw some staff didn't wash their hands". Of course, whether these expressions are borne out by actual purchase behaviour is another matter, but they do confirm awareness of best practice.

"I would be for more confident buying meat from a known, reputable supplier than from a market stall.

-Female, young family, Sharnbrook

> *"I would not purchase food from somewhere unhygienic."*
>
> *-Male, older family, Flitwick*

> *". . . food sold at its best condition and fresh from supplier."*
>
> *-Female, middle age, Ampthill*

> *". . . the weight of a supermarket is itself or at least appears to be a guarantee of safety."*
>
> *-Male, student, Flitwick*

Those who purchased chicken from local butcher believed that these products to be better and tastier than those chickens bought from supermarket. Some also raised the issue about animal welfare and they supposed that chickens reared in battery farms were more easily contaminated with bacteria. The implication here was that local butchers' chickens are perceived to be the product of less intensive systems, which may not necessarily be the case.

> *"I like to shop from the local butcher round the corner that I have known them for years and fill my freezer with their joints."*
>
> *-Female, older family, Ampthill*

4.1.3.5 Post-Purchase Control

Regarding post purchase control, many respondents (20 responses) believed that they could control the food risk in chicken meat themselves, especially when compared with BSE or other food risk. This also suggested that microbiological risks were seen as the main source of risk in chicken, and that they could reduce this risk by careful post-purchase management. The main things were to keep the chicken meat safe such as inspect the chicken meat before purchase, separate chicken meat product from other products, keep the meat in fridge or freezer after purchase and cook well before eating.

> *"I can minimise risks by my handling of chicken after purchase, say consuming within 24 hours, or freezing it on day of purchase, and ensuring the chicken is fully defrosted before cooking."*
>
> *-Male, postgraduate student, Silsoe*

> *"It's important to separate chicken meat product from other products and to keep it at correct temperature after purchase."*
>
> *-Female, middle age, Devon*

It is apparent that most respondents were reasonably well informed on things that they could themselves to reduce the exposure to risk after purchase, assuming that the risks were controllable. They also seemed to have confidence that their actions could be effective for believing "thorough cooking can kill all germs". Whether, people follow good practice is another matter they may be over confident in some of the cases.

> *"We do take extra care with fresh chicken and cook it thoroughly."*
>
> *-Female, young family, Devon*

By and large, most findings are in line with past research, but post-purchase control was brought in as a specific factor associated with food safety risk in chicken meat. The price factor was an undetermined factor linked with food safety, in particular related to chicken. A summary of risk reducing strategies adopted by consumers is presented in Table 4.3.

Table 4.3 Type of Risk Reducing Strategies Associated with Food Safety in Chicken

Risk Reducing Strategy	Number of Repetition	Examples
Product quality	24	Brand loyalty, brand image, quality mark, free-range chicken, and government testing, private testing for ensuring the product is free from food hazard, and traceability to reassure consumers of the product quality and source.
Product information	23	Friends or family recommendation, guidelines or leaflet about food hygiene and food safety as well as labels include product information such as ingredient, nutrition values, cooking instruction and so forth.
Post purchase control	20	Food hazard can be controlled by post purchase action by adopting the best food handling, storage and preparation practices.
Place of purchase	14	Family shop, reputation of the store as well as store image such as hygiene standard for safety product and compare products between shops.
Product Price	11	Extra price for high quality product, special offer, or price reduction to trade off risk and money back for spoiled food.

4.2 Summary of the Chapter

This chapter illustrated a qualitative study which was used to explore the food safety risks in chicken meat and consumer perception of these risks as well as the methods consumer used to reduce their exposure of these risks. The results of the face-to-face interviews with 28 respondents were presented and discussed. The results offer the following conclusions.

- The face-to-face interviewing method which encourages free conversation proved to be successful in obtaining information of thoughts, motives and feelings of the respondents.

- This study confirmed that consumers were able to distinguish sources of risk, assess their relative likelihood and seriousness, and to identify actions that can reduce their exposure to risk. In the case of chicken meat, microbiological risk was perceived to be a particular risk, with significant consequences for personal health and welfare.

- The measurement of perceived risk theory in the context of consumer behaviour was relevant as a framework for understanding consumer perception of the food safety risk and the risk reducing strategies in the times of food scares.

- With modification to the framework of perceived risk theory, the results suggested the importance of lifestyle loss as a separate factor along with health, financial, time and product performance loss as well as social-psychological loss. These losses can be grouped into two main categories related to welfare and quality of life, and personal satisfaction.

- Consistent with the theory of perceived risk, this study confirms that product quality assurance and objectively verifiable food-safety information are essential to support informed purchase decisions by consumers. Consumers also felt able to reduce exposure to food safety risk by their own post-purchase handling and preparation of chicken meat. Place of purchase and price might be helpful to a certain extent. The strategies were proved to be critical to the relief of perceived risk during periods of heightened food safety concern.

- The findings of this qualitative study confirm the relevance of the hypotheses derived from the literature review. There appears to be a negative relationship between consumer risk perception and purchase likelihood (hypothesis 2) and there appears to be a negative relationship between risk reduction and consumer risk perception (hypothesis 3).

As a precursor to more formal methods of enquiry, the findings of this qualitative study contributed to the development of questionnaire design in the subsequent quantitative survey contained in Chapter 5 and 6.

CHAPTER FIVE

5. FOOD RISK CHARACTERISTICS: CONSUMER FOOD PURCHASE MODEL

This chapter presents the results arising from the use of the methodology given in Chapter 3 to assess the linkage between the food risk characteristics, consumer risk perception and the subsequent purchase behaviour (hypothesis 1 and 2). The chapter starts by characterizing the quota samples and showing the descriptive statistics of risk characteristics items. The direct and indirect effects of the relevant risk characteristics on consumer food purchase are discussed. A consumer food purchase model related to risk characteristics is proposed, and subject to improvement, adopted as a basis for explaining factors influencing risk perception and purchase behaviour in the context of food safety and chicken meat.

5.1 Characteristics of Respondents

A quota of 200 consumers was interviewed to mirror the characteristic in the population of interest with respect to age (Section 3.6.1). The characteristics of the respondents are shown in Table 5.1.

Face to face interviews took place over a three month period between June and August 2000 in various locations in the U K (Appendix 15).

Table 5.1 Characteristics of Respondents

Characteristics		Percentage
Age group	16-34	38%
	35-54	40%
	55-70	22%
Gender	Male	48%
	Female	52%
Marital status	Single	22%
	Married	69%
	Others	9%
Education background	Degree holder	28%
	Non-degree holder	72%
Employment status	Employed	55%
	Unemployed	8%
	Others	37%
Income group	Below £15,000 p.a.	38%
	£15,000-19,999 p.a.	19%
	£20,000-29,999 p.a.	17%
	£30,000-49,999 p.a.	20%
	£50,000 p.a. or over	6%

5.2 Test of Personal Characteristics on Future Purchase Likelihood

These quota samples were chosen to reflect the national demographic pattern in age. However, to ensure that the respondent sample was not biased towards a specific type of group, non-parametric tests for inter-group difference in terms of age, gender, martial status, education background and income group were carried out because ordinal scales of data were used. Since purchasing likelihood is the focus of this study, the patterns of purchase likelihood with regard to the above categories were compared. The Mann-Witney test was applied for a two-condition design such as male or female. For three or more conditions, such as age group, income group, Kruskall-Wallis test was conducted to determine if there was a significant difference among groups. The results are shown in Table 5.2.

Table 5.2 Test of Personal Characteristics on Purchase Likelihood

Condition	Significant Probability
Age	0.210
Gender	0.077
Marital status	0.812
Education background	0.592
Employment status	0.095
Income group	0.206

In general, there were no significant difference at 0.05 level among samples in terms of age, gender, marital status, education background, employment status, and income level. It may be due to recent food scares widely covered by media that most people were aware of the consequences of consuming contaminated meat. Alternatively, a bigger sample size is recommended for further investigation. In this research, there was no intention to study any particular group of respondents because there was no significant difference in purchase likelihood found in their personal characteristics. In other words, personal characteristics did not explain variations in purchase behaviour.

5.3 Descriptive Statistics

A preliminary data analysis of median scores was performed to have a general idea of their pattern. Regarding food risk characteristics, this study started with 36 items of which 25 items were used to measure risk characteristics (Table 3.1), 10 items to measure risk perception (Table 3.2) and 1 item to measure purchase likelihood (Table 3.3). Using a Likert-like scale, the item anchors were 1=strongly disagree and 7=strongly agree for risk characteristics, 1=very unlikely and 7=very likely for purchase likelihood. Risk perception was measured by two components of probability of risk occurrence with 1=very unlikely and 7=very likely and the serious of risk occurrence; with 1=not at all and 7=very much.

With respect to risk characteristics, apart from "top on government agenda" [GOV.AGEN] and "choose not to buy chicken with Salmonella" [VOLUNTAR], the median scores were 4 or above (Appendix 16). Likewise, median scores for all risk perception items were 4 or above (Appendix 16). These scores suggest consumers perceived some kinds of losses on chicken consumption if they were contaminated. Alternatively, consumers' intention for future purchase [PURCHASE] was low with median equalled to 3 (Appendix 16), which was measured in weighted average of immediate purchase, purchase after 1 month, 3 months and 6 months. The score shows that consumers would postpone the food purchase in the period of food scares. Because of high score in risk perception, in other words, the respondents perceived high consequent losses, and low purchase likelihood, that is, the respondents were less likely to purchase in the case of concern about food safety, the findings justified the continuation of data analysis.

5.4 Data Purification Using Principal Components Analysis

After screening the data such as normality, multicollinearity and factorability (Section 3.6.5), the correlations among 25 items of food risk characteristics shown in Appendix 2 were analysed using Principal Components Analysis (PCA). Following Kaiser's Criterion, a 9-factor solution with 14 retained items[a] accounted for 69% of variance was preferred (Appendix 17) when compared with a 3-factor solution with 2 retained items[a] accounted for 38% of variance based on scree test described in Section 3.6.5 (Appendix 18). Varimax rotation was carried out to improve the explanation of the result. The Kaiser's criterion approach was also applied to risk reduction model.

As shown in Table 5.3, the observed items which loaded heavily on the first factor were "adverse effect on future generation" [FUTURE], and "adverse effect on the environment" [ENVIRON] with loadings of 0.821 and 0.711 respectively. This factor was labelled 'adverse effect', accounting for 19% of variance.

The observed items with substantial loadings of 0.814 and 0.803 on second factor were "prevented by observing cooking instructions" [COOKINST] and "risk reduced

[a] The rationale is that any loading in excess of 0.71 (50% variance) is considered excellent, 0.63 (40%) very good, 0.55 (30%) good, 0.45 (20%) fair, and 0.32 (10%) poor (Tabachnick and Fidell, 1996).

by thorough cooking" [WELLCOOK] respectively. This factor was labelled 'own-control', accounting for 11% the variance.

Observed items with substantial loadings of 0.791 and 0.810 on third factor were "concerned about the consequence of eating chicken meat" [CONSEQUE] and "concerned about the purchase" [SAFETY] respectively. This factor was labelled 'concern', accounting for 8% of variance.

Observed items with substantial loadings of 0.868 and 0.871 on the fourth factor were "adequate regulations" [ADEQ.REG] and "adequate enforcement of regulation" [ENFORCE] respectively. This factor was labelled 'legislation', accounting for 7% of variance.

Observed items with substantial loadings of 0.813 and 0.871 on the fifth factor were "cannot control easily" [CONTRO.E] and "cannot control quickly" [CONTRO.Q] respectively. The fifth factor was labelled 'uncontrollable', accounting for 6% of variance.

A single observed variable with substantial loading of 0.855 on this factor was "knowledge of microbiological hazard" [KNOWLEDG]. The sixth factor was then labelled 'knowledge', accounting for 5% of variance.

The seventh factor was represented by a single item "activists can exert influences to reduce risk" [ACTIVIST] with substantial loading of 0.792; therefore it was labelled 'influence', which accounted for 5% of variance.

The eighth and ninth factors were also represented by a single item of "incomplete information of microbiological hazard" [INFO] with loading of 0.760 and "choose not to buy chicken meat with Salmonella" [VOLUNTAR] with loading of 0.827. These factors were then labelled 'incomplete' and 'involuntary' respectively, both accounting for 4% of variance.

Table 5.3 Rotated Factor Matrix for Risk Characteristics

	Factor								
	adverse	owncon	concern	legislat	uncontro	knowled	influen	incompl	involunt
KNOWLEDG	-5.92E-02	.103	.136	1.086E-02	2.980E-02	**.855**	5.773E-02	-.103	6.710E-02
IMPACT	-1.25E-02	.183	.351	6.164E-02	.142	.692	.144	-3.69E-02	-.151
CONSEQUE	.146	1.889E-02	**.791**	-2.42E-02	3.168E-02	.233	-5.51E-02	2.853E-02	-.125
INFO	2.861E-02	5.041E-03	.235	-7.14E-02	2.999E-03	-.347	.159	**.760**	-.117
SAFETY	5.675E-02	2.283E-02	**.810**	-5.52E-02	-2.80E-02	.170	.103	-6.94E-03	.130
MEDIA	-6.39E-02	-6.23E-02	-.229	-2.66E-02	4.640E-02	9.709E-02	-.386	.695	.153
SCIENCE	.191	.441	.283	5.413E-02	-.165	.363	-.128	-1.57E-02	-.240
INSTRUCT	4.331E-02	**.814**	-4.39E-02	7.812E-02	-2.52E-02	2.494E-02	-1.32E-02	-5.97E-02	.172
WELLCOOK	-5.86E-02	**.803**	5.117E-02	6.397E-03	3.230E-02	.187	6.375E-02	3.228E-02	-3.97E-02
REGULAT	.376	.410	.378	6.865E-02	-1.97E-02	-3.04E-02	.205	-3.35E-02	6.995E-02
ADEQ.REG	-5.20E-02	.110	-9.06E-02	**.868**	-7.31E-02	.107	-7.68E-02	2.730E-02	-9.40E-05
ENFORCE	-.155	3.574E-02	-2.81E-04	**.871**	-6.96E-02	-2.27E-02	2.716E-02	-6.11E-02	5.752E-02
GOV.AGEN	3.402E-03	-.351	5.319E-02	.505	3.258E-02	-7.87E-02	.213	-4.34E-02	.484
ACTIVIST	3.019E-02	-2.26E-02	6.290E-02	-3.08E-02	.170	-4.38E-04	**.792**	-6.48E-02	.215
PRODUCER	.369	9.400E-02	5.498E-03	3.649E-02	-.108	.243	.673	-1.53E-02	-.126
VOLUNTAR	.166	.150	-6.34E-03	6.879E-02	-4.81E-02	-1.54E-02	5.662E-02	1.403E-02	**.827**
H.INFO	.655	-.111	2.151E-03	-.212	-.141	-2.81E-02	.213	.236	9.776E-03
FUTURE	**.821**	3.039E-02	4.837E-02	-7.44E-02	6.676E-02	-3.73E-03	8.632E-02	-4.94E-02	.156
ENVIRON	**.711**	-1.18E-02	.149	6.794E-02	.310	-7.63E-02	.138	-9.13E-02	-7.07E-02
SPREAD	.472	-3.70E-03	.172	-.195	.370	-1.75E-02	3.424E-02	-.358	.170
S.QUICK	.555	.373	7.574E-02	-4.26E-02	.218	.156	-.128	-1.01E-02	1.929E-02
CONTRO.E	.132	-.173	-5.67E-02	-5.33E-02	**.813**	.139	1.726E-02	8.144E-02	.109
CONTRO.Q	.127	.135	1.794E-02	-4.37E-02	**.823**	-2.85E-03	6.098E-02	-3.11E-02	-.155
INCREASE	.486	.184	.289	-.201	.353	-.151	-.144	-.168	.287
PEO.RISK	.262	.355	.352	-.191	.313	-9.47E-02	.124	-.228	-1.64E-02

Note: items with factor loading greater than 0.71 and cross-loading smaller than 0.32 are highlighted.

5.5 Initial Proposed Model (Model A)

From the result of PCA, nine factors which were labelled 'adverse effect', 'own control', 'concern', 'legislation', 'uncontrollable', 'knowledge', 'influence', 'incomplete information' and 'involuntary' containing 14 items were selected. These 14 items together with 10 items for risk perception (Table 3.2) and the weighted item for purchase likelihood (Table 3.3) were presented in the form of Structural Equation Modelling (SEM), using LISREL 8.30 in order to estimate the effects of each factor.

The food risk characteristics were reduced to eight factors in the resultant SEM. The finalised parameter estimation was performed based on the following mathematical equations for the measurement submodel which expressed the relationship of observed items and latent variables which cannot be measured directly:

Exogenous Variables

$$\text{KNOWLEDG} = \lambda^x_{11}\ \text{knowled} + \delta_1 \quad (5.1)$$

$$\text{CONSEQUE} = \lambda^x_{22}\ \text{concern} + \delta_2 \quad (5.2)$$

$$\text{SAFETY} = \lambda^x_{32}\ \text{concern} + \delta_3 \quad (5.3)$$

$$\text{COOKINST} = \lambda^x_{43}\ \text{owncon} + \delta_4 \quad (5.4)$$

$$\text{ADEQ.REQ} = \lambda^x_{54}\ \text{legislat} + \delta_5 \quad (5.5)$$

$$\text{ENFORCE} = \lambda^x_{64}\ \text{legislat} + \delta_6 \quad (5.6)$$

$$\text{ACTIVIST} = \lambda^x_{75}\ \text{influen} + \delta_7 \quad (5.7)$$

$$\text{VOLUNTAR} = \lambda^x_{86}\ \text{involunt} + \delta_8 \quad (5.8)$$

$$\text{FUTURE} = \lambda^x_{97}\ \text{adverse} + \delta_9 \quad (5.9)$$

$$\text{ENVIRON} = \lambda^x_{107}\ \text{adverse} + \delta_{10} \quad (5.10)$$

$$\text{CONTRO.E} = \lambda^x_{118}\ \text{uncontro} + \delta_{11} \quad (5.11)$$

$$\text{CONTRO.Q} = \lambda^x_{128}\ \text{uncontro} + \delta_{12} \quad (5.12)$$

Mediating Variables

$$L.HEALTH = \lambda^{y}_{11}\ riskper + \varepsilon_1 \tag{5.13}$$

$$L.MONEY = \lambda^{y}_{21}\ riskper + \varepsilon_2 \tag{5.14}$$

$$L.TIME = \lambda^{y}_{31}\ riskper + \varepsilon_3 \tag{5.15}$$

$$L.LIFEST = \lambda^{y}_{41}\ riskper + \varepsilon_4 \tag{5.16}$$

$$L.TASTE = \lambda^{y}_{51}\ riskper + \varepsilon_5 \tag{5.17}$$

Endogenous Variable

$$PURCHASE = \lambda^{y}_{62}\ purchli + \varepsilon_6 \tag{5.18}$$

Where λ^{x}_{ij} is the factor loading between the i^{th} observed item for the exogenous variable and the j^{th} exogenous variable

λ^{y}_{ij} is the factor loading between the i^{th} observed item for the endogenous variable and the j^{th} endogenous variable

δ_i is the error for the i^{th} observed item for the exogenous variable

ε_j is the error for the j^{th} observed item for the endogenous variable

and for the structural submodel which expressed the relationship between the latent variables as follow:

$$riskper = \gamma_{11}\ knowled + \gamma_{12}\ concern + \gamma_{13}\ owncon + \gamma_{14}\ legislat + \gamma_{15}\ influen + \gamma_{16}\ involunt + \gamma_{17}\ adverse + \gamma_{18}\ uncontro + \zeta_1 \tag{5.19}$$

$$purchli = \beta_{21}\ riskper + \zeta_2 \tag{5.20}$$

Where γ_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} exogenous variable

β_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} endogenous variable

ζ_i is the structural error of the i^{th} endogenous variable

A total of 67 free parameters was estimated using the weighted least square method on the correlation matrix (Appendix 19). In this study, the conditions of identification were readily satisfied. Because the structural submodel was a recursive model, items were linked only to single factors, and the number of free parameters to be estimated was less than half of the number of variances and covariances amongst the items (Appendix 20). As a result of this process, a model showing the relationship between food risk characteristics and consumer purchase behaviour was constructed. The model, with eight latent exogenous variables, a latent mediating variable and a latent endogenous variable is tabulated in Table 5.4. This initial model is denoted Model A.

Table 5.4 Factors of the Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics

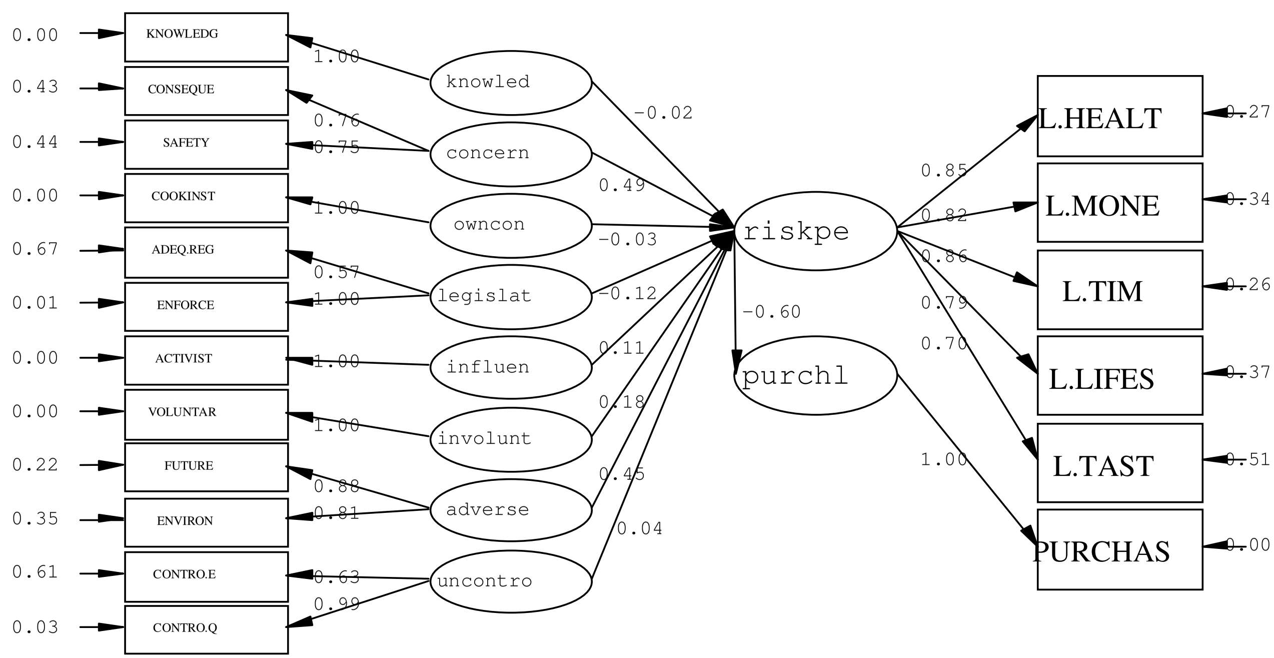
Exogenous Variables	**Observed Items**
Food Risk Characteristics	
knowledge [knowled]	knowledge of microbiological hazard [KNOWLEDG]
concern [concern]	concerned about the consequence [CONSEQUE] concerned about the purchase" [SAFETY]
own-control [owncon]	prevented by observing cooking instructions [COOKINST]
legislation [legislat]	adequate regulations [ADEQ.REG] adequate enforcement of regulation [ENFORCE]
influence [influen]	activists can exert influences to reduce risk [ACTIVIST]
involuntary [involunt]	choose not to buy chicken meat with Salmonella" [VOLUNTAR]
adverse effect [adverse]	adverse effect on future [FUTURE] adverse effect on environment [ENVIRON]
uncontrollable [uncontro]	cannot control easily [CONTRO.E] cannot control quickly [CONTRO.Q]

Table 5.4 Factors of the Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristic (cont.)

Mediating Variables	Observed Items
risk perception [riskper]	
	adverse effect on health [L.HEALTH]
	money wasted [L.MONEY]
	time lost [L.TIME]
	adverse effect on lifestyle [L.LIFEST]
	adverse effect on the taste [L.TASTE]

Endogenous Variables	Observed Items
purchasing likelihood [purchli]	future purchase [PURCHASE]

Figure 5.1 Path Diagram of the Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics



Chi-Square=225.08, df=104, P-value=0.00000, RMSEA=0.076

5.5.1 Path Diagram of Model A

A path diagram was drawn showing the relationship among the items and factors in the proposed Model A after the measurement and structural submodel equations were specified (Figure 5.1). The results shown in Table 5.5 were obtained. The item loading was the variance explained by the latent variables for each item. For instance, the factor 'concern' explains 0.76 or 76% of variance of the item [CONSEQUE] and 0.75 or 75% of [SAFETY].

5.5.2 Evaluation of Model A

The estimates of the measurement submodel and the structural submodel was assessed in terms of their reliability and validity.

5.5.2.1 Reliability of Measurement Submodel

The reliability of measurement submodel was assessed in terms of item reliability, Cronbach alpha and factor reliability for ensuring the internal consistency (Section 3.3.6.4).

From Table 5.6, all items met or exceeded the recommended guideline of 0.40, but "adequate regulations" [ADEQ.REG] and "cannot control easily" [CONTRO.E] with 0.33 and 0.39 respectively were marginally below the acceptable threshold. The results suggested that all items were reliable as they reflected mostly the true scores for the intended factor (latent variable). The minimum value of Cronbach alpha for all factors was 0.70, which satisfied the guideline of 0.70 (Appendix 8) as an acceptable reliable measure of factor. Correspondingly, the minimum value of factor reliability was 0.72 for 'concern' which was well above the guideline of 0.50. The figures suggested that the variance captured by the factor was more than by the error component. On the whole, both item and factor reliability were assumed, since the measures of reliability provide evidence of measurement consistency in the model.

Table 5.5 Factors with Item Loadings – Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics

Factors/Items	Item loading	S. D.	t-value
Food Risk Characteristics			
knowledge [knowled]			
knowledge of microbiological hazard [KNOWLEDG]	1.00	0.04	28.21
concern [concern]			
concerned about the consequence [CONSEQUE]	0.76	0.04	21.53
concerned about the safety [SAFETY]	0.75	0.04	20.07
own-control [owncon]			
prevented by observing cooking instructions [COOKINST]	1.00	0.04	28.21
legislation [legislat]			
adequate regulations [ADEQ.REG]	0.57	0.04	15.57
adequate enforcement of regulation [ENFORCE]	1.00	0.03	30.61
influence [influen]			
activists can exert influences to reduce risk [ACTIVIST]	1.00	0.04	28.21
involuntary [involunt]			
choose not to buy chicken meat with Salmonella [VOLUNTAR]	1.00	0.04	28.21

All t-value are significant at $p = 0.00$.

Table 5.5 Factors with Item Loadings - Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics (cont.)

Factors/Items	Item loading	S. D.	t-value
Food Risk Characteristics			
adverse effect [adverse]			
adverse effect on future [FUTURE]	0.88	0.03	30.21
adverse effect on environment [ENVIRON]	0.81	0.03	31.12
uncontrollable [uncontro]			
cannot control easily [CONTRO.E]	0.63	0.04	14.07
cannot control quickly [CONTRO.Q]	0.99	0.06	15.29
Risk Perception			
risk perception [riskper]			
adverse effect on health [L.HEALTH]	0.85	-	-
money wasted [L.MONEY]	0.81	0.02	46.06
time lost [L.TIME]	0.86	0.02	46.12
adverse effect on lifestyle [L.LIFEST]	0.79	0.02	33.75
adverse effect on the taste [L.TASTE]	0.70	0.03	20.01
Purchase Likelihood			
purchase likelihood [purchli]			
future purchase [PURCHASE]	1.00	-	-

All t-values are significant at $p = 0.00$.

Table 5.6 Reliability of the Proposed Consumer Food Purchase Model (Model A) Relating to Risk Characteristics

Factors/ items	Item reliability	Cronbach alpha	Factor reliability
knowled	-	-	-
[KNOWLEDG]	1.00	-	-
concern	-	0.70	0.72
[CONSEQUE]	0.57	-	-
[SAFETY]	0.56	-	-
owncon	-	-	-
[COOKINST]	1.00	-	-
legislat	-	0.80	0.78
[ADEQ.REG]	0.33	-	-
[ENFORCE]	0.99	-	-
influen	-	-	-
[ACTIVIST]	1.00	-	-
involunt	-	-	-
[VOLUNTAR]	1.00	-	-
adverse	-	0.77	0.83
[FUTURE]	0.78	-	-
[ENVIRON]	0.65	-	-
uncontro	-	0.70	0.80
[CONTRO.E]	0.39	-	-
[CONTRO.Q]	0.97	-	-
riskper	-	0.92	0.89
[L.HEALTH]	0.73	-	-
[L.MONEY]	0.66	-	-
[L.TIME]	0.74	-	-
[L.LIFEST]	0.63	-	-
[L.TASTE]	0.49	-	-
purchli	-	-	-
[PURCHASE]	1.00	-	-

5.5.2.2 Validity of Measurement Submodel

The validity of the measurement submodel was assessed by convergent validity, discriminant validity and average variance extracted (Section 3.3.6.4) in order to ensure that the factor reflects what the items are supposed to measure.

Convergent validity was satisfied since all items were statistically significant and reliable with minimum t-value equalled 14.07 ($p = 0.00$) for item [CONTRO.E] and maximum standard deviation [S.D.] equalled to 0.06 for item [CONTRO.Q] (Appendix 21). Correspondingly, only items with loading greater than 0.71 and with low cross loading of less than 0.32 were selected for the model. Both methods guaranteed that the items designed to measure the same factor were related.

Discriminant validity was satisfied from the results of 45 pairwise tests among 10 latent variables of food risk characteristics, risk perception and purchase likelihood (Appendix 22). For instance, 25.98 was the lowest difference in value of χ^2 between adverse effect [adverse] and uncontrollable [uncontol] from pairwise tests. The result indicated that the correlations among all latent variables were significantly different from unity.

Average variance extracted was drawn by using equations 3.11 and 3.12 (Appendix 9) to present evidence for the amount of variance of factors in the measurement submodel. All measures met or exceeded the recommended threshold of 0.50 since the minimum value of average variance extracted was 0.57 [concern] (Appendix 23). The values of average variance extracted showed that all factors were valid because the variance due to measurement error was smaller than the variance captured by the factor.

5.5.2.3 Assessment of Structural Submodel

Following the assessment of the measurement submodel, the validity of the structural submodel was tested by the total coefficient of determination to assess the relationship between characteristics of food risk, risk perception and purchase likelihood. Using the equation 3.13 (Appendix 10), the value of 0.70 for the total coefficient of determination was obtained. The figure suggested that there was a good joint relationship between factors and the model has a good predictive power for purchase likelihood (Joreskog and Sorbom, 1998). The next step was to assess the overall fit of Model A.

5.5.3 Overall Model Fit of Model A

From Table 5.7, all absolute fit indices fell above the threshold of 0.90 which reflected a good fit (Table 3.5), and the proposed model was adequately representing the entire set of causal relationships. The power estimate for the test of close fit was 0.96 which was sufficiently powerful to reject an incorrect model (Section 3.6.6.8). These confirmed that there was a real effect of food risk characteristics on risk perception and subsequently influencing purchase likelihood. The proposed Model A was viewed as an acceptable model.

Table 5.7 Overall Model Fit of the Proposed Model (Model A) for Consumer Food Purchase Relating to Risk Characteristics

Goodness of Fit Statistics
Absolute fit
Degrees of Freedom = 104
Minimum Fit Function Chi-Square = 225.08 (P = 0.00)
Goodness of Fit Index (GFI) = 0.97
Adjusted Goodness of Fit Index (AGFI) = 0.96
Root Mean Square Error of Approximation (RMSEA) = 0.076
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.96
Comparative fit
Comparative Fit Index (CFI) = 0.97
Incremental Fit Index (IFI) = 0.97
Relative Fit Index (RFI) = 0.93
Parsimonious fit
Parsimony Goodness of Fit Index (PGFI) = 0.59
Parsimony Normed Fit Index (PNFI) = 0.65

5.6 Rival Model (Model B)

In accordance with modelling practice, an attempt was made to construct a rival model based on theory (denoted Model B) as a plausible model. From previous research, knowledge, concern, own control, legislation, activist influence, involuntary, adverse effect and uncontrollable have been identified as factors leading to consumer risk perception. These factors were included in Model A. These factors are seen to be relevant if the consequence is uncertain and the hazard is unknown to the scientists and the experts. Nevertheless, microbiological hazards are found to be different from those hazards which have a greater perceived degree of uncertain consequence.

Based on recent research, the majority of respondents are well aware of the serious consequence of microbiological contamination. However they know that thorough cooking of meat can reduce the risk of food poisoning associated with microbiological hazards (Miles, Braxton and Frewer, 1999). People feel able to control this type of food risk themselves at home by cooking well (Yeung and Morris, 2001b). It may be the reason why the demand of chicken meat is increasing even though a high percentage of poultry carries *Salmonella*. In this context, 'knowledge' and 'own control' were clearly seen to be factors influencing the purchase likelihood with no relief of risk perception.

For this reason, direct path from 'knowledge' and 'own control' were added to purchase likelihood and the paths from risk perception were deleted. The results of Model B were obtained after the corresponding equations 5.19 and 5.20 were converted as follows:

$$\text{riskper} = \gamma_{12}\,\text{concern} + \gamma_{14}\,\text{legislat} + \gamma_{15}\,\text{influen} + \gamma_{16}\,\text{involunt} + \gamma_{17}\,\text{adverse} + \gamma_{18}\,\text{uncontro} + \zeta_1 \qquad (5.21)$$

$$\text{purchli} = \gamma_{21}\,\text{knowled} + \gamma_{23}\,\text{owncon} + \beta_{21}\,\text{riskper} + \zeta_2 \qquad (5.22)$$

Where γ_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} exogenous variable

β_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} endogenous variable

ζ_i is the structural error of the i^{th} endogenous variable

A total of 67 free parameters was estimated by LISREL 8.30. Similar to Model A, the degree of freedom was 104, so that the conditions of identification were readily satisfied (Appendix 24). The data was rerun through LISREL 8.30 for Model B after equations of measurement and structural submodel were specified and the results shown in Table 5.8 were then obtained.

Table 5.8 Factors with Item Loadings – Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics

Factors/Items	Item loading	S. D.	t-value
Food Risk Characteristics			
knowledge [knowled]			
knowledge of microbiological hazard [KNOWLEDG]	1.00	0.04	28.32
concern [concern]			
concerned about the consequence [CONSEQUE]	0.78	0.04	21.66
concerned about the safety [SAFETY]	0.73	0.04	20.19
own-control [owncon]			
prevented by observing cooking instructions [COOKINST]	1.00	0.03	28.78
legislation [legislat]			
adequate regulations [ADEQ.REG]	0.63	0.04	15.39
adequate enforcement of regulation [ENFORCE]	0.97	0.03	29.44
influence [influen]			
activists can exert influences to reduce risk [ACTIVIST]	1.00	0.04	28.15
involuntary [involunt]			
choose not to buy chicken meat with Salmonella [VOLUNTAR]	1.00	0.03	28.47

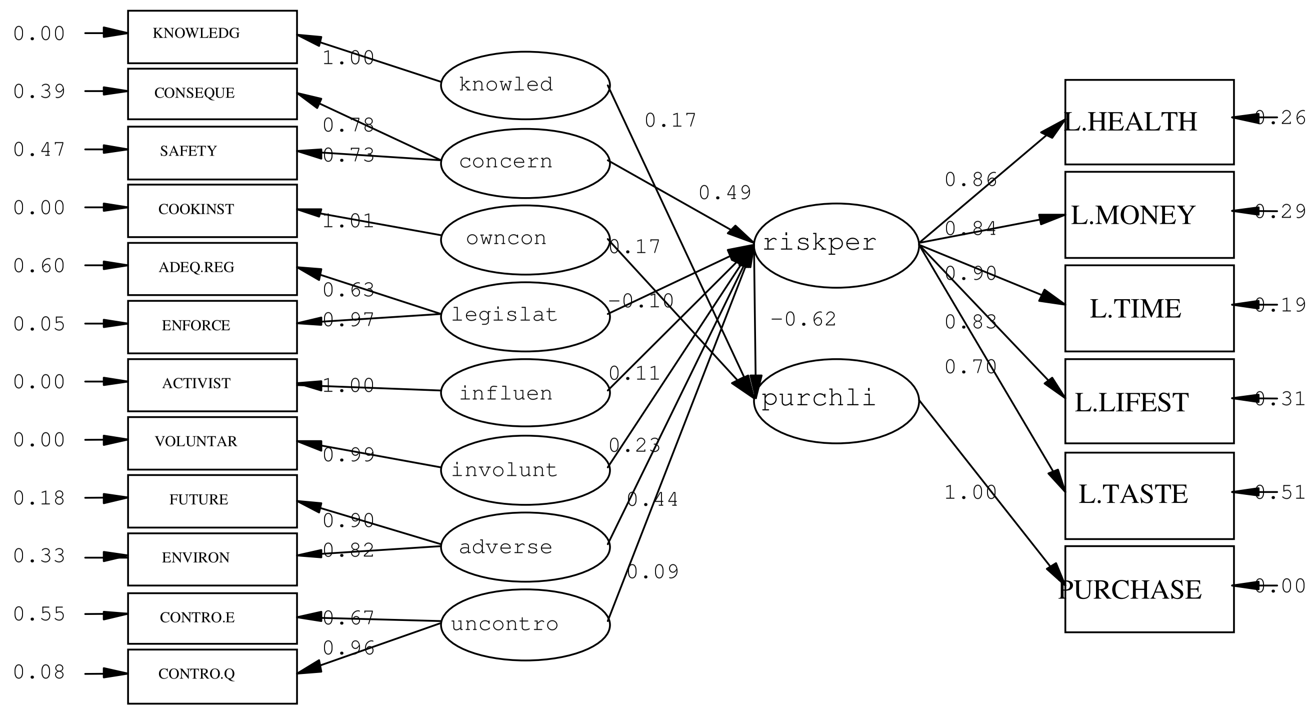
All T-value are significant, $p = 0.00$.

Table 5.8 Factors with Item Loadings – Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics (cont.)

Factors/Items	Item loading	S. D.	t-value
Food Risk Characteristics			
adverse effect [adverse]			
adverse effect on future [FUTURE]	0.90	0.03	31.42
adverse effect on environment [ENVIRON]	0.82	0.02	33.31
uncontrollable [uncontro]			
cannot control easily [CONTRO.E]	0.67	0.04	15.72
cannot control quickly [CONTRO.Q]	0.96	0.06	17.40
Risk Perception			
risk perception [riskper]			
adverse effect on health [L.HEALTH]	0.86	-	-
money wasted [L.MONEY]	0.84	0.02	48.47
time lost [L.TIME]	0.90	0.02	46.12
adverse effect on lifestyle [L.LIFEST]	0.83	0.02	35.00
adverse effect on the taste [L.TASTE]	0.70	0.03	20.96
Purchase Likelihood			
purchase likelihood [purchli]			
future purchase [PURCHASE]	1.00	-	-

All T-value are significant, p = 0.00.

Figure 5.2 Path Diagram of the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics



Chi-Square=186.39, df=104, P-value=0.00000, RMSEA=0.063

5.6.1 Path Diagram of Model B

A path diagram shown in Figure 5.2 was drawn showing the relationship among the factors and items in Model B. For instance, the factor 'concern' explains 0.78 or 78% of variance of the item [CONSEQUE] and 0.73 or 73% of the item [SAFETY]. The coefficients of measurement items of rival model and their effects on the latent variables were in Appendix 25.

5.6.2 Evaluation of Model B

The reliability and validity of the items were guaranteed since the rival Model B was estimated by same items as those in the proposed Model A.

Because of the converted path from risk perception to purchase likelihood for 'knowledge' and 'own control' of the food risk characteristics, the total coefficient of determination of the rival model was recalculated and obtained by using the equation 3.13. The rival Model B has a better value of 0.78, which suggested that this model has a better predictive power for purchase likelihood than the originally proposed Model A.

5.6.3 Overall Model Fit of Model B

As shown in Table 5.9, all absolute fit indices lay above the threshold of 0.90. Again, the result suggested that Model B was adequately representing the entire set of causal relationships. This also confirmed that 'knowledge' and 'own control' have a direct impact on purchase likelihood.

Table 5.9 Overall Model Fit of the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics

Goodness of Fit Statistics

Absolute fit
- Degrees of Freedom = 104
- Minimum Fit Function Chi-Square = 186.39 (P = 0.00)
- Goodness of Fit Index (GFI) = 0.98
- Adjusted Goodness of Fit Index (AGFI) = 0.96
- Root Mean Square Error of Approximation (RMSEA) = 0.063
- Normed Fit Index (NFI) = 0.96
- Non-Normed Fit Index (NNFI) = 0.97

Comparative fit
- Comparative Fit Index (CFI) = 0.98
- Incremental Fit Index (IFI) = 0.98
- Relative Fit Index (RFI) = 0.94

Parsimonious fit
- Parsimony Goodness of Fit Index (PGFI) = 0.59
- Parsimony Normed Fit Index (PNFI) = 0.65

5.6.4 Comparison of Model A with Model B

The comparisons of overall goodness of fit between proposed model and rival model were shown in Table 5.10. The criteria for comparing the two models were the absolute fit indices, comparative indices, parsimonious fit indices, and number of significant paths.

Table 5.10 Comparison of the Proposed Model (Model A) and the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics

	Model A	Model B
Absolute fit indices		
χ^2 (d.f.)	225.08 (104)	186.62 (104)
GFI	0.97	0.98
AGFI	0.96	0.96
RMSEA	0.076	0.063
NFI	0.95	0.96
NNFI	0.96	0.97
Comparative fit indices		
CFI	0.97	0.98
IFI	0.97	0.98
RFI	0.93	0.94
Parsimonious fit indices		
PGFI	0.59	0.59
PNFI	0.65	0.65
Number of significant paths	6/9	9/9

As per absolute fit indices, only AGFI remained the same, all other indices of the rival model suggested slightly improvement for overall fitness. For instance, GFI, NFI and NNFI of the rival model obtained higher value approaching 1 as perfect fit and RMSEA with lower value reflecting a very good fit. Hence, under this category, Model B appeared to be better than Model A.

According to comparative fit indices, all the indices for the rival model were better than the proposed model. This finding implied that Model B provides the better fit to the data than Model A.

There was no difference in parsimonious fit indices between the two models. Moreover, there were more significant paths in the rival model than in the proposed model. The power estimate of close fit for the two models was the same. These suggested that the rival model has a greater explanatory power than the proposed model.

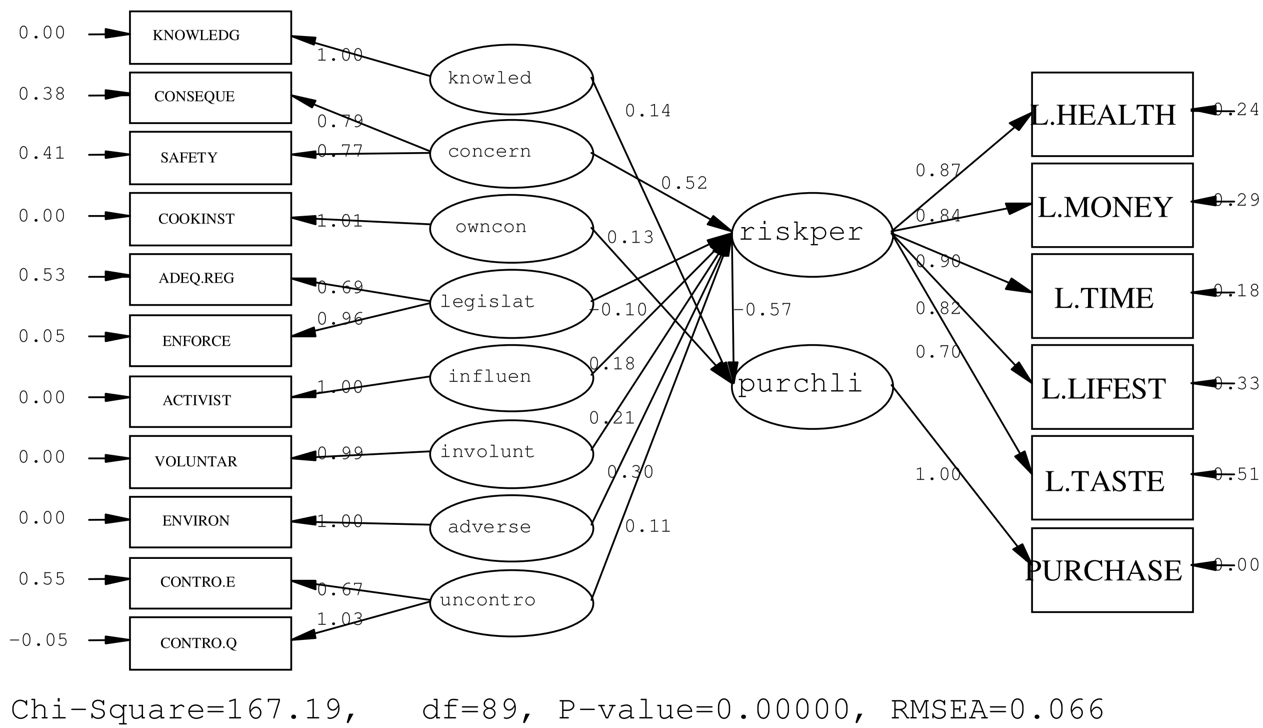
By and large, the results suggested that the rival model was better than the proposed model. The former model provided a stronger relationship among the factors and therefore was selected for further improvement.

5.7 Improvement to Model B

By examining the diagnostic elements of modification indices, there was no significant improvement by adding any relationship between the factors suggested (Appendix 26). Nevertheless, from the standardised residual matrix, [FUTURE] was called the 'offending item' because the standardised residual exceeded the threshold of 2.58 (Appendix 27). In other words, the residual significantly departed from zero if the item [FUTURE] was included. The item was therefore deleted from Model B accordingly.

A new model labelled Model B_1 was then developed after a new equation was defined. A path from item [FUTURE] to risk perception was deleted by fixing the parameter λ^x_{97} in equation 5.9 equals to zero. The model specification of Model B_1 is shown in Appendix 28. The data was then rerun through LISREL 8.30 for Model B_1. A path diagram is shown in Figure 5.3 and the result is summarised in Appendix 29.

Figure 5.3 Path Diagram of the Modified Model (Model B$_1$) for Consumer Food Purchase Relating to Risk Characteristics



5.7.1 Comparison of Model B_1 with Model B

The comparisons of overall goodness of fit between the modified model and the rival model were shown in Table 5.11. Though the number of significant paths for both models was the same, all fit indices including the absolute fit indices, comparative indices, parsimonious fit indices of Model B were better than Model B_1. This suggested that Model B is better than Model B_1. The rival Model B was therefore adopted as empirical model because it showed a stronger relationship among the factors with better model fit. It was adequately describing the causal relationships between risk characteristics, consumer risk perception and purchase likelihood.

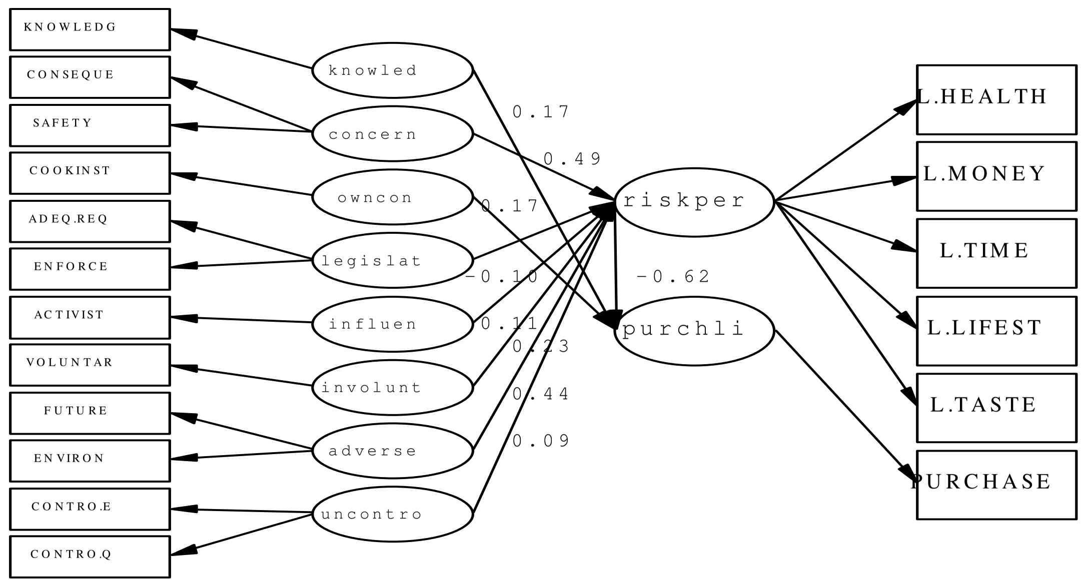
Table 5.11 Comparison of the Modified Model (Model B_1) and the Rival Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics

	Model B_1	Model B
Absolute fit indices		
χ^2 (d.f.)	167.19 (89)	186.62 (104)
GFI	0.97	0.98
AGFI	0.96	0.96
RMSEA	0.066	0.063
NFI	0.95	0.96
NNFI	0.96	0.97
Comparative fit indices		
CFI	0.97	0.98
IFI	0.97	0.98
RFI	0.92	0.94
Parsimonious fit indices		
PGFI	0.57	0.59
PNFI	0.62	0.65
Number of significant paths	9/9	9/9

5.8 Hypothesis testing

After adopting the best model (the rival Model B) shown in Figure 5.4, the relationships with respect to Hypotheses 1 and 2 were tested (Section 3.3). The estimated path coefficients shown in Table 5.12 reflect the relative importance of each exogenous variables to risk perception and in turn to purchase likelihood. The effects of risk characteristics on risk perception and the effect of risk perception on purchase likelihood were confirmed. Apart from the relationships between uncontrollable risk and risk perception, and legislation and risk perception which are supported at 0.05 significance level, all other relationships are supported at 0.01 significance level.

Figure 5.4 Path Diagram of the Adopted Model (Model B) for Consumer Food Purchase Relating to Risk Characteristics



Chi-Square=186.39, df=104, P-value=0.00000, RMSEA=0.063

Table 5.12 Effects of Food Risk Characteristics to Risk Perception and Purchase Likelihood (Based on Model B)

		To	
Hypotheses	**From**	**Risk Perception**	**Purchase Likelihood**
	Risk Characteristics		
1a	concern	0.49 (12.25**)	-0.31 (-9.58**)
1b	adverse effect	0.44 (9.47**)	-0.28 (-9.82**)
1c	involuntary	0.23 (4.65**)	-0.15 (-4.59**)
1d	activist influence	0.11 (2.67**)	-0.07 (-2.64**)
1e	uncontrollable	0.09 (2.33*)	-0.05 (-2.31*)
1f	legislation	-0.10 (-2.54*)	0.07 (2.51*)
	knowledge	---	0.17 (4.52**)
	own control	---	0.17 (4.47**)
2	**Risk Perception**	---	-0.62 (-16.95**)

Notes:
Figures indicated are path coefficient estimate and (t-value)
Significance level:
** $p \leq 0.01$
* $p \leq 0.05$

PhD Thesis, 2002

5.9 Discussion

The preceding analysis confirms a relationship between food risk characteristics, risk perception and purchase likelihood. Eight factors were identified for risk characteristics, of which six have either positive or negative relationship with risk perception, and two have positive relationship with purchase likelihood. This finding was inconsistent with previous studies which have used three factors to capture the risk characteristics (Slovic, 1987; Sparks and Shepherd, 1994a; Fife-Schaw and Rowe, 1996). This area warrants further research. The finding on relationship between consumer risk perception and purchase behaviour are however, in line with previous studies (Bauer, 1967; Mitchell and Greatorex, 1989; Tse, 1999). As expected, consumer perception of risk has a negative relationship with purchase likelihood (Huang, 1993; Eom, 1994).

5.9.1 Risk Characteristics and Risk Perception

Risk characteristics identified in this study include 'concern', 'adverse effect', 'involuntary', 'activist influence', 'uncontrollable' and 'legislation'. Apart from 'legislation', all are positively related to consumer risk perception. They are discussed in turn:

5.9.1.1 Concern and Risk Perception

Among all constructs, consumer 'concern' (causal effect of 0.49) has the highest positive causal effect on risk perception. As shown in the qualitative study, consumers are concerned about a number of safety issues related to food production, process and handling by the food industry (Yeung and Morris, 2001b). Consumer concern seems to be supported by the repeated incidents of food poisoning, some of which have proved fatal for vulnerable groups. Consumer concern heightens because of the severe consequence of microbiological hazards associated with the consumption of chicken meat. Inevitably, consumers tend to perceive high risk if they are concerned about the consequence of the food risk (Fischhoff, Slovic, Lichtenstein, Read and Combs, 1978), and the analysis confirms this.

5.9.1.2 Adverse Effect and Risk Perception

'Adverse effect' (causal effect of 0.44) has the second highest positive causal effect on consumer risk perception. This characteristic captures the uncertainty and possibly delayed effects of hazardous events. The uncertain nature and the increasing evidence of long term effects of microbiological hazards tend to magnify consumer risk perception. Consumers perceive that an uncertain delayed effect is worse than an immediate harmful effect to health (Slovic, Fischhoff and Lichtenstein, 1980). Like with the BSE crisis, consumers stopped eating beef due to the long incubation period of affecting *nvCJD* (Anderson, 1999). Because of the fear of the potential adverse effect, consumers project a possible threat to the health of future generations, and environment (Marris and Langford, 1996).

5.9.1.3 Involuntary and Risk Perception

'Involuntary' (causal effect of 0.23) has moderate positive causal effect on consumer risk perception. This characteristic refers to the unwillingness of the exposure of the food risk because they feel they are not well informed or have limited choice. Respondents from this study commented that they did not know which chicken products were contaminated because of the high percentage of *Salmonella* detected in poultry. The only way to avoid the harmful effect is not to buy. Thus, they perceived that their right to free choice is compromised (Walkley, 1999). The involuntariness of taking risk would correspondingly affect consumer risk perception (Wandel, 1994).

5.9.1.4 Activist Influence and Risk Perception

'Activist influence' (causal effect of 0.11) has a low positive causal effect on consumer risk perception. Since the activists and consumer pressure groups such as Greenpeace, and Consumers' Association are perceived to be independent from the government and the food industry, their actions indeed affect consumer risk perception. These organisations keep lobbying the government to amend the regulations to ensure the quality of food supply, to minimise risks from food, and, in the context of intensive production methods, to improve animal welfare. The news reported on these movements draw public attention to food safety hazards. Negative events very often carry greater weight than positive events (Slovic, 1998). In turn, the actions of campaigning organisations help to influence and for the most part increase consumer perception of risk.

5.9.1.5 Uncontrollable and Risk Perception

'Uncontrollable' (causal effect of 0.09) has a significant albeit relatively small effect on consumer risk perception. This refers to microbiological hazards in chicken which cannot be easily or quickly controlled. The perception of 'uncontrollable' may be due to laboratory reports showing the increasing incidence of food poisoning or the result from a random sample test revealing a significant number of chickens from local supermarkets being contaminated. Certainly, some bacteria such as *Campylobacter* that cause food poisoning are unfamiliar to consumers even though they are common and on the increase. Companies such as Marks and Spencer and also the Food Standard Agency admitted that they were struggling with *Campylobacter* in their chicken products (FSA, 2001b). Consumers perceive that the control of food risk by the science and technology is a good predictor of risk level (Powell, 1998). The activities of pressure groups may also give impressions to consumers that food hazards are not under control. Risk perceptions tend to increase if the risk is perceived to be inadequately controlled (Frewer, Shepherd and Sparks, 1994b). However, in the case of microbiological risks, the characteristic of 'uncontrollable' does not have much effect on consumer risk perception since consumers perceived that post purchase control may be exercised to eliminate food risks through food preparation. This argument will be discussed in a later section.

5.9.1.6 Legislation and Risk Perception

'Legislation' (causal effect of -0.10) in the form of regulations and control of food standards was identified to reduce consumer risk perception. The extent of effect depends on how consumers perceive regulations to be enforced. Doubtless, consumers ask for tight regulations to protect them from harm if there is a risk (Slovic, 1987). Nevertheless, the link between nv*CJD* in humans with *BSE* and high levels of *Salmonella* in poultry suggest some inadequacy and failure of the food law. In the case of this study, legislation seems to exert an influence and reduces consumer perception of risk but to a minimum degree. Legislation linked to an enforcement regime would be key to restore consumer confidence and to reduce perceived risk. Simultaneously, industry needs to demonstrate compliance with regulations, exceeding minimum standards by adopting externally verified quality assurance protocols.

5.9.2 Risk Characteristics and Purchase Likelihood

Two characteristics of risk were identified in relation to purchase likelihood in this study. The former has a positive relationship with the latter. They are discussed in turn:

5.9.2.1 Knowledge and Purchase Likelihood

'Knowledge' (causal effect of 0.17) has a positive relationship with purchase likelihood. This finding was consistent with previous research showing that knowledge motivates changes in consumer behaviour (Teague and Anderson, 1995). A survey conducted by the Food and Drink Federation in 1996 has shown that consumers had enough information about storage, preparation and cooking in order to keep meat safe. They are aware of the health warnings and importance of certain codes of good practice on food safety in particular for microbiological hazards (Worsfold and Griffith, 1997). Thus, knowledge may indeed raise the awareness of actual risk and close the gap between the perceived and actual risk, especially where there is a solution to control the food risk. Certainly, microbiological risk can be controlled by proper handling and cooking of the chicken. Knowledge of this kind may favour purchase likelihood. There is an important educational role for the food industry, especially retailers, and for those organisations engaged in public health.

5.9.2.2 Own Control and Purchase Likelihood

'Own control' (causal effect of 0.17) has positive relationship with purchase likelihood. Most respondents of both studies generally understood that thorough cooking can kill all potentially harmful bacteria like *Salmonella* and *E. Coli*, consequently, they perceived that the risk is under their control. They contended that the food risk did not affect their purchase provided that they cooked the chicken thoroughly. The results also showed that both knowledge and own control have the same positive effect on purchase likelihood. This is consistent with previous research that there is a close relationship between own control and knowledge (e.g. Frewer, Howard, Hedderley and Shepherd, 1998). It is likely that consumers have the knowledge of how to use proper cooking methods to guard against bacteria. Undoubtedly, consumers who claim to have the knowledge about microbiological hazards are likely to know how to reduce the risk such as cook well, closely following the cooking instructions for preparing meals. In the case of microbiological risk, consumers very often prefer to cook at home instead of buying cooked meat from market stalls or delicatessen because they believe it is under their control. In this respect, the occurrence of food risk does not entirely discourage the food purchase.

5.9.3 Risk Perception and Purchase Likelihood

Risk perception (causal effect of -0.62) has a strong negative relationship with purchase likelihood. This reflects that the latter will be adversely affected if consumers perceive a risk in food. This is consistent with the theory of perceived risk (e.g. Bauer, 1967; Mitchell and Boustani, 1992). Five significant components of consumer risk perception were confirmed, namely: health loss, money loss, time loss, lifestyle loss, and taste loss. This quantified the findings of the earlier exploratory study of consumer perception on food safety related risk (Yeung and Morris, 2001b). Respondents mentioned that all perceived losses were serious to them but the first four were perceived to be overlapping together because of linked consequences such as days off work or study, financial problems if out of job and restricted lifestyle follows health loss. This is in line with other research (e.g. Stern, 1985). Taste loss is not related to health problems but it appears to be important since most respondents said that they purchased chicken because of its flavour. Tastes in food are the mark of the man (Gofton, 1986). Nevertheless, the taste of chicken is adversely affected by overcooking due to the safeguarding of killing all bacteria. All these losses are perceived to be a consequence of consuming contaminated chicken. For this reason, consumers' purchase likelihood is negatively affected.

5.10 Summary of the Chapter

This chapter applied an analytical framework to assess the link between food risk characteristics, risk perception and purchase likelihood with respect to food safety related risk. The results from the assessment of linkage on microbiological hazards in chicken meat have been presented and discussed (hypotheses 1 and 2). The following conclusion can be drawn:

- For the study sample, there was no difference in purchase likelihood pattern between personal characteristics, such as age, gender, martial status, education, employment and income with respect to microbiological hazards in chicken meat. *Salmonella* was the most commonly known microbiological hazard and perceived to be controlled by thorough cooking.

- The Structural Equation Modelling proved successful in identifying the risk characteristics which were the causal factors for consumer risk perception and the subsequent purchase. The effects of individual risk characteristics on risk perception and on purchase likelihood were determined.

- A consumer food purchase model linking with risk characteristics was built to assess the causal effects of risk characteristics and risk perception on purchase likelihood. The model provided a framework to measure how consumers' subsequent purchase was influenced by consumer perception of risk as affected by characteristics of food risk in times of concern about food safety. The inconsistency of eight factors identified with previous studies however required further investigation.

- Each risk characteristics has an individual effect on consumer risk perception in different degree. For instance, concern about consequence and safety of food consumption demonstrates to have the strongest influence on risk perception among other characteristics. Uncontrollable risk was the lowest influence on consumer perception of risk. Consumer risk perception was particularly shaped by concern, regarding the adverse effect on future generation and environment, involuntary exposure to the food risk, and activist influence which called for the control of risk.

- Legislation helped to reduce consumer risk perception. In other words, the results suggested that consumer risk perception would be modified if the regulations were perceived to be adequate and properly enforced.

- There was no evidence to show any significant effect of perceived knowledge and perceived own control on risk perception. However, the results suggested a positive relationship between these two characteristics and the purchase likelihood. These two characteristics were seen to be closely related in the case of microbiological hazards in chicken meat. For instance, people seemed to have confidence to handle the risk on their own control if they perceived they know the storage or cooking procedure. Purchase likelihood was clearly seen to depend on how consumers perceived a food risk, and their knowledge about and their perceived control over the risk during the period of concern about food safety.

- Consumer perception of food safety related risk was mainly caused by food risk characteristics, and in turn, the effects of these characteristics indirectly shaped the purchase likelihood. Consumer risk perception with respect to microbiological hazards in chicken meat was measured in terms of the consequences for health, finance, time, lifestyle and taste.

The analysis so far has examined risk factors which shape risk perception and the effect on purchasing behaviour. The next chapter explores how consumers might adopt strategies to reduce perception of safety related risk in a food purchasing context.

CHAPTER SIX

6. RISK REDUCTION: CONSUMER FOOD PURCHASE MODEL

This chapter presents the results arising from the use of the methodology given in Chapter 3 to assess the linkage between the risk reducing strategies, consumer risk perception and subsequent purchase behaviour (hypotheses 2 and 3). The chapter starts by showing the descriptive statistics of risk reduction items. The direct and indirect effects of the relevant risk reducing strategies on consumer food purchase are discussed. A consumer food purchase model related to risk reduction is obtained.

6.1 Descriptive Statistics

The study started with 28 items of which 17 items were used to measure risk reduction (see Table 3.4), 10 items to measure risk perception (see Table 3.2) and 1 item to measure purchase likelihood (see Table 3.3). Using a Likert-like scale, the measurements and the scores for risk perception and purchase likelihood were the same as those used to measure risk characteristics (Appendix 16). The item anchors were 1=very unlikely and 7=very likely for risk reduction.

A preliminary data analysis of median scores was performed to give a general idea of the rating for the items of risk reduction, risk perception and purchase likelihood. Apart from "purchase product with price reduction" [PRI.RED], the median scores for all risk reduction items were 4 or above (Appendix 16). The scores suggest that most risk reducing strategies were useful in a period of concern about food safety. The explanation of the scores for risk perception and purchase likelihood is presented in

Section 5.3 above. The score of most risk reduction items was high. In other words, these items were likely to be used by the respondents in times of concern about food safety. This finding justified continuing to study their effect on consumer perception of food safety related risk.

6.2 Data Purification Using Principal Components Analysis

Following screening the data (Section 3.6.5), the correlations among 17 items of risk reduction shown in Appendix 30 were analysed. Following Kaiser's Criterion as discussed in Section 3.6.5, Principal Components Analysis (PCA) revealed that 5 factors accounted for 64% of variance based on Kaiser Criterion (Appendix 31). Varimax rotation was carried out to improve the explanation of the result.

As shown in Table 6.1 the observed items which loaded heavily on the first factor were "tested by government laboratory" [GOV.LAB], "tested by private laboratory" [PRIV.LAB] and "traced to the original producer" [TRACEABI] with loadings of 0.768, 0.814 and 0.739 respectively. This factor was labelled 'quality assurance', accounting for 30% of variance.

The observed items with substantial loadings of 0.767 and 0.816 on the second factor were "purchase the same brand" [LOYALTY] and "choose a well-known brand" [W.BRAND] respectively. This factor was labelled 'brand', accounting for 10% the variance.

Observed items with substantial loadings of 0.805 and 0.850 on the third factor were "reading consumer guide" [GUIDE] and "reading in-store leaflet " [LEAFLET] respectively. This factor was labelled 'information', accounting for 9% of variance.

The fourth factor was represented by two substantial items of "keeping meat in fridge/freeze after purchase" [KEEPCOLD] and "separating chicken meat from other products" [SEPARATE] with loadings of 0.881 and 0.768 respectively. It was then labelled 'post purchase control', accounting for 6% of variance.

The fifth factor was represented by two substantial items of "price reduction" [PRI.RED] and "shopping around for special offer" [SHOPPING] with substantial loadings of 0.740 and 0.844 respectively. It was therefore labelled 'price discount', accounting for 6% of variance.

Table 6.1 Rotated Factor Matrix for Risk Reduction

	Factors				
	quality	brand	inform	ppcon	price
LOYALTY	.165	**.767**	4.300E-02	.210	-2.53E-02
BRAND	.189	**.816**	.165	.116	-.110
MON.BACK	.302	.441	.409	3.536E-02	.158
QUALITY	.484	.475	.357	.154	-2.27E-02
GOV.LAB	**.768**	.244	.268	-6.06E-02	8.097E-02
PRIV.LAB	**.814**	-3.18E-03	.196	-2.76E-02	.165
TRACEABI	**.739**	.166	8.513E-02	.120	1.199E-02
P.REDUCE	5.761E-02	9.977E-02	6.188E-03	-8.85E-02	**.740**
ORGANIC	.554	.204	-3.49E-02	.181	-7.98E-02
SHOPPING	-1.06E-02	5.897E-03	2.505E-03	7.609E-02	**.844**
AVAILABL	6.599E-02	.655	.122	6.981E-02	.367
ADVICE	.195	.453	1.241E-02	4.562E-02	.359
GUIDES	.226	.129	**.805**	.191	-.124
LEAFLET	.119	.121	**.850**	6.257E-02	4.483E-02
SELFINSP	6.366E-02	6.543E-02	.488	.560	.201
KEEPCOLD	8.859E-02	.141	4.922E-02	**.881**	6.379E-02
SEPARATE	7.791E-02	.169	.121	**.768**	-.144

Note: items with factor loading greater than 0.71 and cross-loading smaller than 0.32 are highlighted.

6.3 Proposed Model (Model C)

From the result of PCA, five factors labelled ‘quality assurance’, ‘brand’, ‘information’, ‘post purchase control’ and ‘price discount’ containing 11 observed items were selected. These 11 items together with 10 items for risk perception (Table 3.2) and the weighted item for purchase likelihood (Table 3.3) were presented in the form of Structural Equation Modelling (SEM), using LISREL 8.30 in order to estimate the effects of each factor.

The risk reducing strategies were reduced to five factors in the resultant SEM. By assuming constant effects of risk characteristics on consumer risk perception, fhe finalised parameter estimation was obtained after the following equations were derived for the measurement submodel, which expressed the relationship of the observed items and the latent variables:

Exogenous Variables

$$\text{LOYALTY} = \lambda^{x}_{11}\,\text{brand} + \delta_1 \quad (6.1)$$

$$\text{W.BRAND} = \lambda^{x}_{21}\,\text{brand} + \delta_2 \quad (6.2)$$

$$\text{GOV.LAB} = \lambda^{x}_{32}\,\text{quality} + \delta_3 \quad (6.3)$$

$$\text{PRIV.LAB} = \lambda^{x}_{42}\,\text{quality} + \delta_4 \quad (6.4)$$

$$\text{TRACEABI} = \lambda^{x}_{52}\,\text{quality} + \delta_5 \quad (6.5)$$

$$\text{PRI.RED} = \lambda^{x}_{63}\,\text{price} + \delta_6 \quad (6.6)$$

$$\text{GUIDE} = \lambda^{x}_{74}\,\text{inform} + \delta_7 \quad (6.7)$$

$$\text{LEAFLET} = \lambda^{x}_{84}\,\text{inform} + \delta_8 \quad (6.8)$$

$$\text{KEEPCOLD} = \lambda^{x}_{95}\,\text{ppcon} + \delta_9 \quad (6.9)$$

$$\text{SEPARATE} = \lambda^{x}_{105}\,\text{ppcon} + \delta_{10} \quad (6.10)$$

Mediating Variables

$$\text{L.HEALTH} = \lambda^y_{11}\ \text{riskper} + \varepsilon_1 \qquad (6.11)$$

$$\text{L.MONEY} = \lambda^y_{21}\ \text{riskper} + \varepsilon_2 \qquad (6.12)$$

$$\text{L.TIME} = \lambda^y_{31}\ \text{riskper} + \varepsilon_3 \qquad (6.13)$$

$$\text{L.LIFEST} = \lambda^y_{41}\ \text{riskper} + \varepsilon_4 \qquad (6.14)$$

$$\text{L.TASTE} = \lambda^y_{51}\ \text{riskper} + \varepsilon_5 \qquad (6.15)$$

Endogenous Variable

$$\text{PURCHASE} = \lambda^y_{62}\ \text{purchli} + \varepsilon_6 \qquad (6.16)$$

Where λ^x_{ij} is the factor loading between the i^{th} observed item for the exogenous variable and the j^{th} exogenous variable

λ^y_{ij} is the factor loading between the i^{th} observed item for the endogenous variable and the j^{th} endogenous variable

δ_i is the error for the i^{th} observed item for the exogenous variable

ε_j is the error for the j^{th} observed item for the endogenous variable

The equations were derived for the structural submodel which expressed the relationship between the latent variables as follow:

$$\text{riskper} = \gamma_{11}\ \text{brand} + \gamma_{12}\ \text{quality} + \gamma_{13}\ \text{price} + \gamma_{14}\ \text{inform} + \gamma_{15}\ \text{ppcon} + \zeta_1 \qquad (6.17)$$

$$\text{purchli} = \beta_{21}\ \text{riskper} + \zeta_2 \qquad (6.18)$$

Where γ_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} exogenous variable

β_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} endogenous variable

ζ_i is the structural error of the i^{th} endogenous variable

A total of 46 free parameters was estimated using the weighted least square method on the correlation matrix (Appendix 32). In this study, the conditions of identification were readily satisfied. Because the structural submodel was a recursive model, items were linked only to single factors, and the number of free parameters to be estimated was less than half of the number of variances and covariances amongst the items (Appendix 33). As a result of this process, a model showing the relationship between consumer risk reduction and consumer purchase behaviour was constructed. This model, denoted Model C, has five latent exogenous variables and two latent endogenous variables and tabulated in Table 6.2. A path diagram of the proposed model shown in Figure 6.1 was drawn.

Table 6.2 Factors of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction

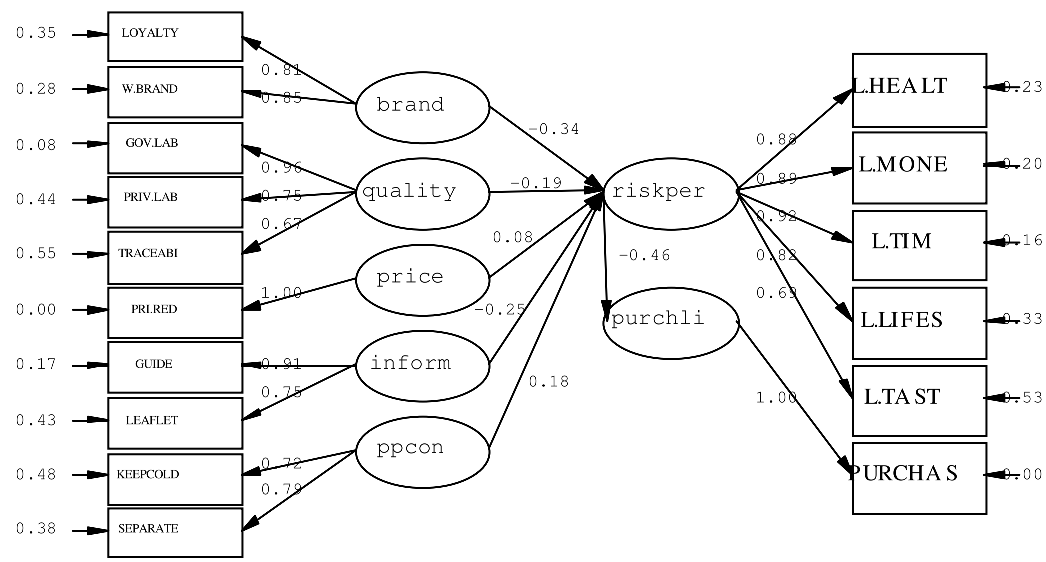
Exogenous Variables	Observed Items
Risk Reducing Strategies	
quality assurance [quality]	tested by government laboratory [GOV.LAB] tested by private laboratory [PRIV.LAB] traced to the original producer [TRACEABI]
brand [brand]	purchase the same brand [LOYALTY] choose a well-known brand" [W.BRAND]
information [inform]	reading consumer guide [GUIDE] reading in-store leaflet [LEAFLET]
post purchase control [ppcon]	keeping meat in fridge/freeze after purchase [KEEPCOLD] separating chicken meat from other product [SEPARATE]
price discount [price]	price reduction [PRI.RED]

Table 6.2 Factors of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction (cont.)

Mediating Variables	Observed items
risk perception [riskper]	adverse effect on health [L.HEALTH]
	money wasted [L.MONEY]
	time lost [L.TIME]
	adverse effect on lifestyle [L.LIFEST]
	adverse effect on the taste [L.TASTE]

Endogenous Variables	Observed items
purchasing likelihood [purli]	future purchase [PURCHASE]

Figure 6.1 Path Diagram of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction



Chi-Square=140.56, df=90, P-value=0.00052, RMSEA=0.053

6.3.1 Path Diagram of Model C

A path diagram was drawn showing the relationship among the items and factors in Model C after the measurement and structural submodel equations were specified (Figure 6.1). The results shown in Table 6.3 were obtained. The item loading was the variance explained by the latent variables for each item. For instance, the factor 'brand' explains 81% of variance of the item [LOYALTY] and 85% of [W.BRAND].

6.3.2 Evaluation of Model C

The estimates of the measurement submodel and the structural submodel were assessed in terms of their reliability and validity.

6.3.2.1 Reliability of Measurement Submodel

The reliability of measurement submodel was assessed in terms of item reliability, Cronbach alpha and factor reliability for ensuring the internal consistency (Section 3.3.6.4).

From Table 6.4, all items met or exceeded the recommended guideline of 0.40 for item reliability. The results suggested that all items were reliable as they reflected mostly the true scores for the intended factor (latent variables). The minimum value of Cronbach alpha for all factors was 0.73, which satisfied the guideline of 0.70 (Appendix 8) as an acceptable reliable measure of factor. Correspondingly, the minimum value of factor reliability was 0.73 for 'post purchase control', which was well above the guideline of 0.50. This figure suggested that the variance captured by the factor was more than by the error component. On the whole, both item and factor reliability were assumed, since the measures of reliability provided evidence of measurement consistency in the model.

Table 6.3 Factors with Item Loadings - Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction

Factors/Items	Item Loading	S. D.	t-value
Risk Reducing Strategies			
brand [brand]			
purchase the same brand [LOYALTY]	0.81	0.04	18.22
choose a well-known brand [W.BRAND]	0.85	0.04	19.46
quality assurance [quality]			
tested by government laboratory [GOV.LAB]	0.96	0.03	31.86
tested by private laboratory [PRIV.LAB]	0.75	0.04	19.69
traced to the original producer [TRACEABI]	0.67	0.05	14.84
price discount [price]			
price reduction [PRI.RED]	1.00	0.04	28.21
information [inform]			
reading consumer guide [GUIDE]	0.91	0.04	21.28
reading in-store leaflet [LEAFLET]	0.75	0.05	16.74
post purchase control [ppcon]			
keeping meat in fridge/freeze after purchase [KEEPCOLD]	0.72	0.06	12.02
separating chicken meat from other product [SEPARATE]	0.79	0.06	12.97

All t-value are significant at $p = 0.00$.

Table 6.3 Factors with Item Loadings - Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction (cont.)

Factors/Items	Item Loading	S. D.	t-value
Risk Perception			
risk perception [riskper]			
adverse effect on health [L.HEALTH]	0.88	-	-
money wasted [L.MONEY]	0.89	0.03	26.88
time lost [L.TIME]	0.92	0.03	29.15
adverse effect on lifestyle [L.LIFEST]	0.82	0.04	22.63
adverse effect on the taste [L.TASTE]	0.69	0.05	14.98
Purchase Likelihood			
purchasing likelihood [purchli]			
future purchase [PURCHASE]	1.00	-	-

All t-value are significant at $p = 0.00$.

Table 6.4 Reliability of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction

Factors/ items	Item Reliability	Cronbach alpha	Factor Reliability
brand	-	0.75	0.81
[LOYALTY]	0.65	-	-
[W.BRAND]	0.72	-	-
quality	-	0.79	0.84
[GOV.LAB]	0.92	-	-
[PRIV.LAB]	0.56	-	-
[TRACEABI]	0.45	-	-
price	-	-	-
[PRI.RED]	1.00	-	-
Inform	-	0.78	0.83
[GUIDE]	0.83	-	-
[LEAFLET]	0.57	-	-
ppcon	-	0.73	0.73
[KEEPCOLD]	0.52	-	-
[SEPARATE]	0.62	-	-
riskper	-	0.92	0.89
[L.HEALTH]	0.73	-	-
[L.MONEY]	0.66	-	-
[L.TIME]	0.74	-	-
[L.LIFEST]	0.63	-	-
[L.TASTE]	0.49	-	-

6.3.2.2 Validity of Measurement Submodel

The validity of the measurement submodel was assessed by convergent validity, discriminant validity and average variance extracted (Section 3.3.6.4).

Convergent validity was satisfied since all items were statistically significant and reliable with minimum t-value equalled to 12.02 ($p = 0.00$) for item [KEEPCOLD] and maximum standard deviation [S.D.] equalled to 0.06 for both items [KEEPCOLD] and [SEPARATE] (Appendix 34). Correspondingly, only items with loading greater than 0.71 and with low cross loading of less than 0.32 have been selected for the model. Both methods guaranteed that the items actually measure what are supposed to measure.

Discriminant validity was satisfied from the results of 21 pairwise tests among 7 latent variables of risk reduction, risk perception and purchase likelihood (Appendix 35). For instance, 39.23 was the lowest difference in value of χ^2 between brand [brand] and post purchase control [ppcon] from pairwise tests. The result indicated that the correlations among all latent variables were significantly different from unity.

Average variance extracted was drawn by using equations 3.11 and 3.12 (Appendix 9) to present evidence for the amount of variance of factors in the measurement submodel. All measures met or exceeded the recommended threshold of 0.50 since the minimum value of average variance extracted was 0.57 [ppcon] (Appendix 36). The values of average variance extracted showed that all factors were valid because the variance due to measurement error was smaller than the variance captured by the factor.

6.3.2.3 Assessment of Structural Submodel

Following the assessment of the measurement submodel, the validity of the structural submodel was tested by the total coefficient of determination to assess the relationship between risk reduction, risk perception and purchase likelihood. Using the equation 3.13 (Appendix 10), the value of 0.32 for the total coefficient of determination was obtained. The estimate suggested that there was a joint relationship between factors and the model has an acceptable predictive power for purchase likelihood (Joreskog and Sorbom, 1998). The next step was to assess the overall fit of the model.

6.3.3 Overall Model Fit of Model C

From Table 6.5, all absolute fit indices fell above the threshold of 0.90 which reflected a good fit (Table 3.5), and the proposed Model C was adequately representing the entire set of causal relationships. The power estimate for the test of close fit was 0.94 which was sufficiently powerful to reject an incorrect model (Section 3.6.6.8). These confirmed that there was a real effect of risk reduction taken by consumers on risk perception and subsequently influencing purchase likelihood from the result of this study. The proposed Model C was viewed as an acceptable model.

Table 6.5 Overall Model Fit of the Proposed Consumer Food Purchase Model (Model C) Relating to Risk Reduction

Goodness of Fit Statistics
Absolute fit
Degrees of Freedom = 90
Minimum Fit Function Chi-Square = 140.56 (P = 0.00)
Goodness of Fit Index (GFI) = 0.97
Adjusted Goodness of Fit Index (AGFI) = 0.96
Root Mean Square Error of Approximation (RMSEA) = 0.053
Normed Fit Index (NFI) = 0.94
Non-Normed Fit Index (NNFI) = 0.97
Comparative fit
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.92
Parsimonious fit
Parsimony Goodness of Fit Index (PGFI) = 0.65
Parsimony Normed Fit Index (PNFI) = 0.71

6.4 Rival Model (Model D)

From the discussion in Section 3.6.6.9, a rival model, denoted Model D was constructed as a plausible model. From previous research, brand, product quality, price, product information and post-purchase control have been identified as a factor helping to relieve consumer risk perception. These factors have generally applied to reducing risk perception when the outcome of product purchase is under performance and disappointment rather than potentially hazardous and harmful to the consumer. However, price reductions are often used to encourage purchases of the offending product as well as to trade off consumer perceived risk in the times of concern about food safety.

For this reason, 'price discount' was included in the rival Model D as a factor directly influencing purchase likelihood. A direct path from 'price discount' was added to purchase likelihood. The results of Model D were obtained after the corresponding equations 6.18 were converted as follows:

$$\text{purchli} = \gamma_{23}\ \text{price} + \beta_{21}\ \text{riskper} + \zeta_2 \qquad (6.19)$$

Where γ_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} exogenous variable

β_{ij} is the regression coefficient between the i^{th} endogenous variable and the j^{th} endogenous variable

ζ_i is the structural error of the i^{th} endogenous variable

A total of 47 free parameters was estimated by LISREL 8.30. Similar to Model C, the conditions of identification were readily satisfied (Appendix 37). The data was rerun through LISREL 8.30 for Model D after equations of measurement and structural submodel were specified and the results shown in Table 6.6 were then obtained.

Table 6.6 Factors with Item Loadings – Rival Model (Model D) for Risk Reduction in Consumer Food Purchase

Factors/Items	Item Loading	S. D.	t-value
Risk Reducing Strategies			
brand [brand]			
purchase the same brand [LOYALTY]	0.81	0.04	18.15
choose a well-known brand [W.BRAND]	0.84	0.04	19.30
quality assurance [quality]			
tested by government laboratory [GOV.LAB]	0.96	0.03	31.35
tested by private laboratory [PRIV.LAB]	0.74	0.04	19.29
traced to the original producer [TRACEABI]	0.67	0.05	14.61
price discount [price]			
price reduction [PRI.RED]	1.00	0.04	28.39
information [inform]			
reading consumer guide [GUIDE]	0.92	0.04	20.96
reading in-store leaflet [LEAFLET]	0.74	0.05	16.18
post purchase control [ppcon]			
keeping meat in fridge/freeze after purchase [KEEPCOLD]	0.73	0.06	12.15
separating chicken meat from other product [SEPARATE]	0.79	0.06	12.99

All t-value are significant at $p = 0.00$

Table 6.6 Factors with Item Loadings – Rival Model (Model D) for Risk Reduction in Consumer Food Purchase (cont.)

Factors/Items	Item Loading	S. D.	t-value
Risk Perception			
risk perception [riskper]			
adverse effect on health [L.HEALTH]	0.88	-	-
money wasted [L.MONEY]	0.89	0.03	26.75
time lost [L.TIME]	0.91	0.03	29.05
adverse effect on lifestyle [L.LIFEST]	0.82	0.04	22.47
adverse effect on the taste [L.TASTE]	0.69	0.05	14.87
Purchase Likelihood			
purchasing likelihood [purchli]			
future PURCHASE]	1.00	-	-

All t-values are significant at $p = 0.00$

6.4.1 Path Diagram of Model D

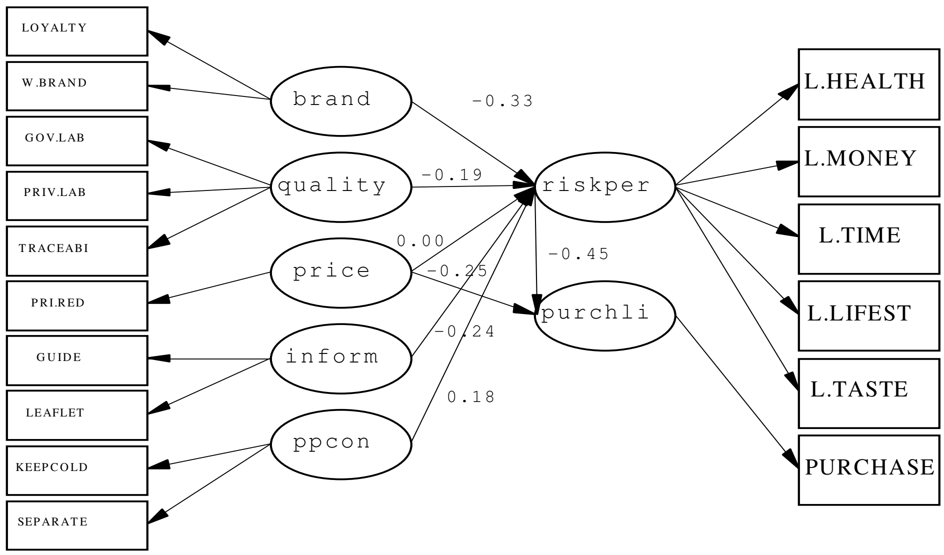
A path diagram show in Figure 6.2 was drawn showing the relationship among the factors and items in the rival model. For instance, the factor 'brand' explains 81% of variance of the item [LOYALTY] and 84% of the item [W.BRAND]. The coefficients of measurement items of Model D and their effects on the latent variables are given in Appendix 38.

6.4.2 Evaluation of the Rival Model

The reliability and validity of the items were guaranteed since the rival Model D was estimated by the same items as those in the proposed Model C.

Because of the added path of 'price discount' to purchase likelihood, the total coefficient of determination of Model D was recalculated and obtained by using the equation 3.13. The rival Model D has a better value of 0.37, which suggested that this model has a better predictive power for purchase likelihood than the originally proposed Model C.

Figure 6.2 Path Diagram of the Rival Model (Model D) for Risk Reduction in Consumer Food Purchase



Chi-Square=127.49, df=89, P-value=0.00468, RMSEA=0.047

6.4.3 Overall Model Fit of Model D

As shown in Table 6.7, all absolute fit indices lay above the threshold of 0.90. Again, the result suggested that Model D was adequately representing the entire set of causal relationships.

Table 6.7 Overall Model Fit of the Rival Model (Model D) for Risk Reduction in Consumer Food Purchase

Goodness of Fit Statistics
Absolute fit
Degrees of Freedom = 89
Minimum Fit Function Chi-Square = 127.49 (P = 0.00)
Goodness of Fit Index (GFI) = 0.98
Adjusted Goodness of Fit Index (AGFI) = 0.96
Root Mean Square Error of Approximation (RMSEA) = 0.047
Normed Fit Index (NFI) = 0.95
Non-Normed Fit Index (NNFI) = 0.98
Comparative fit
Comparative Fit Index (CFI) = 0.98
Incremental Fit Index (IFI) = 0.98
Relative Fit Index (RFI) = 0.93
Parsimonious fit
Parsimony Goodness of Fit Index (PGFI) = 0.64
Parsimony Normed Fit Index (PNFI) = 0.70

6.4.4 Comparison of Model C with Model D

The comparisons of overall goodness of fit between proposed Model C and rival Model D were shown in Table 6.8. The criteria for comparing the two models were the absolute fit indices, comparative indices, parsimonious fit indices, and number of significant paths.

As per absolute fit and comparative indices, only GFI, NFI, NNFI and RFI showed slightly improvement, there were no changes for all other indices of the rival model. Both models had two insignificant paths and the same power estimate for the test of close fit. In this aspect, there was no difference between Models C and D. However, the parsimonious fit indices showed a lower score for the rival model. This suggested that the proposed Model C was better than the rival Model D. The originally proposed Model C was chosen for further improvement.

Table 6.8 Comparison of the Proposed Model (Model C) and the Rival Model (Model D) for Risk Reduction in Consumer Food Purchase

	Model C	Model D
Absolute fit indices		
χ^2 (d.f.)	140.56 (90)	127.49 (89)
GFI	0.97	0.98
AGFI	0.96	0.96
RMSEA	0.053	0.047
NFI	0.94	0.95
NNFI	0.97	0.98
Comparative fit indices		
CFI	0.98	0.98
IFI	0.98	0.98
RFI	0.92	0.93
Parsimonious fit indices		
PGFI	0.65	0.64
PNFI	0.71	0.70
Number of significant paths	4/6	5/7

6.5 Improvement to Model C

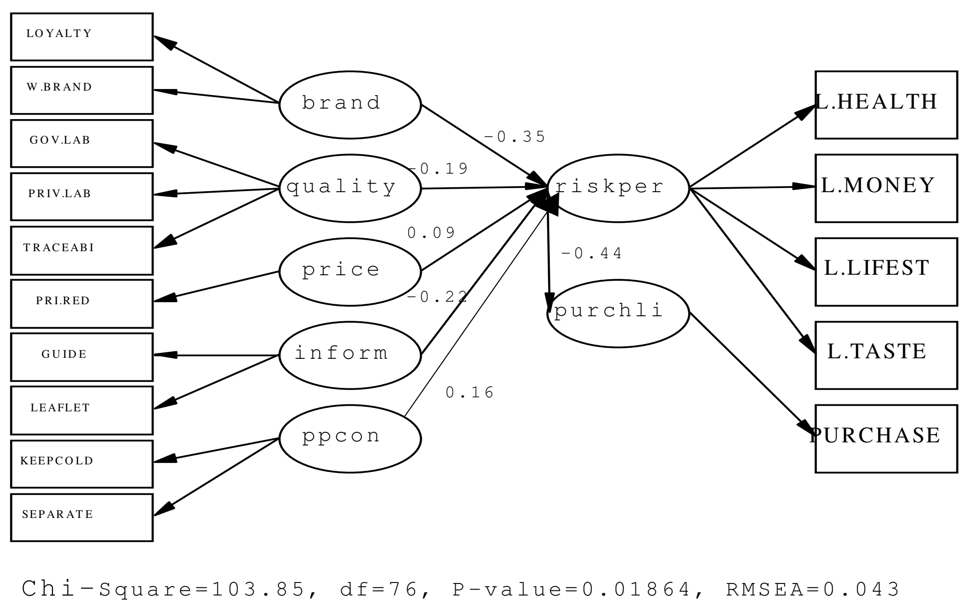
By examining the diagnostic elements of modification indices, it was considered that Model C could be improved by adding a relationship from price [price] to purchase likelihood [purchli] (m.i. = 11.38) (Appendix 39). The suggestion was a replica of Model D. There was no other significant improvement to be given by adding any relationship between the factors.

From the standardised residual matrix, [L.TIME], [L.MONEY] and [GUIDE] were called the 'offending items' because their standardised residuals exceeded the threshold of 2.58 (Appendix 40). In other words, the residuals significantly departed from zero if including these items. These items namely, [L.TIME], [L.MONEY] and

[GUIDE] were therefore deleted from Model C accordingly. Thus, three new modified models labelled C_1, C_2 and C_3 were developed after the corresponding equations were deleted as below:

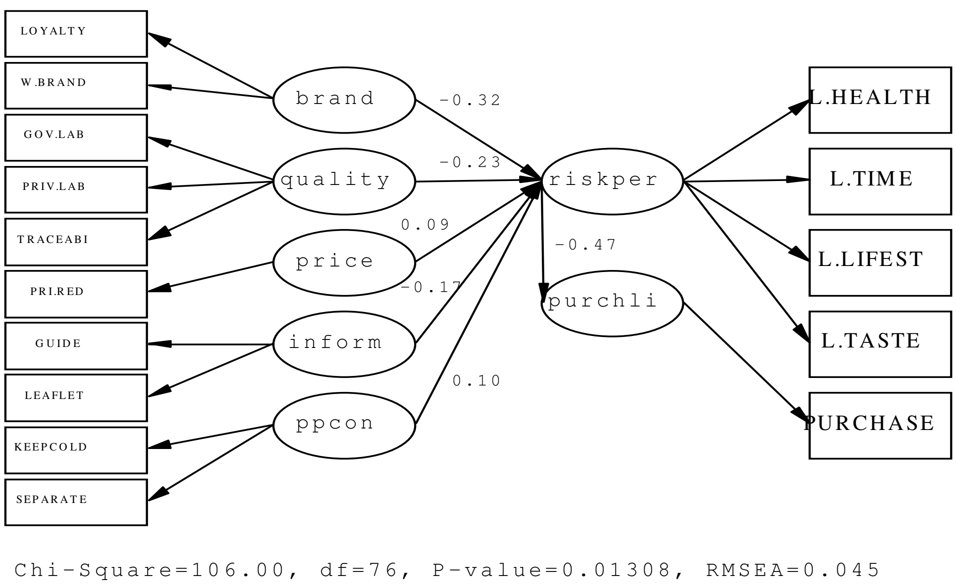
- For the modified Model C_1, a path from item [L.TIME] to risk perception was deleted by fixing the parameter λ^y_{31} in equation 6.13 equalled to zero. The specification of Model C_1 is shown in Appendix 41. A path diagram is shown in Figure 6.3 and the result is summarised in Appendix 42.

Figure 6.3 Path Diagram of the Modified Model C_1 for Risk Reduction in Consumer Food Purchase



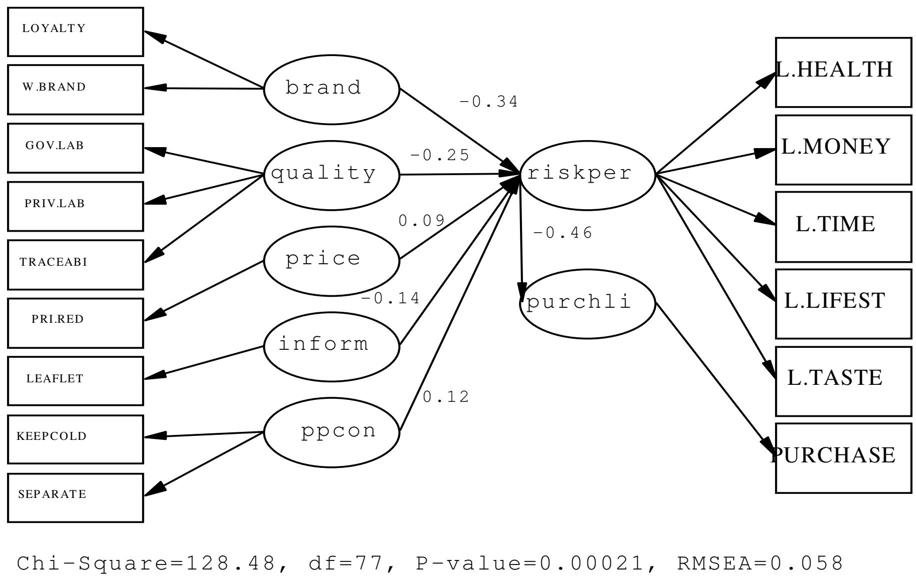
- For the modified Model C_2, a path from item [L.MONEY] to risk perception was deleted by fixing the parameter λ^y_{21} in equation 6.12 equalled to zero. The specification of Model C_2 is shown in Appendix 43. A path diagram is shown in Figure 6.4 and the result is summarised in Appendix 44.

Figure 6.4 Path Diagram of the Modified Model C_2 for Risk Reduction in Consumer Food Purchase



- For the modified Model C_3, a path from item [GUIDE] to information was deleted by fixing the parameter λ^y_{74} in equation 6.7 equalled to zero. The specification of Model C_3 is shown in Appendix 45. A path diagram is shown in Figure 6.5 and the result is summarised in Appendix 46.

Figure 6.5 Path Diagram of the Modified Model C_3 for Risk Reduction in Consumer Food Purchase



6.5.1 Comparison of the Proposed Model with the Modified Models

The data was rerun through LISREL 8.30 for Models C_1, C_2 and C_3. The comparison of overall goodness of fit between the proposed Model C and the modified Models C_1, C_2 and C_3 is shown in Table 6.9. Apart from GFI, all other fit indices including the absolute fit indices, comparative indices, parsimonious fit indices were of lower value and the numbers of significant path were reduced in all three modified models. This suggested that the initially proposed Model C was the best among all models. Thus, the originally proposed Model C was adopted as empirical model because it showed a stronger relationship among the factors. This model was adequately describing the causal relationships between risk reduction, consumer risk perception and purchase likelihood.

Table 6.9 Comparison of the Proposed Model (Model C) and the Modified Models (Models C_1, C_2, and C_3) for Risk Reduction in Consumer Food Purchase

	Model C	Model C_1	Model C_2	Model C_3
Absolute fit indices				
χ^2 (d.f.)	140.56 (90)	103.85 (76)	106.00 (76)	128.48 (77)
GFI	0.97	0.98	0.98	0.97
AGFI	0.96	0.96	0.96	0.96
RMSEA	0.053	0.043	0.045	0.058
NFI	0.94	0.94	0.94	0.94
NNFI	0.97	0.98	0.98	0.96
Comparative fit indices				
CFI	0.98	0.98	0.98	0.97
IFI	0.98	0.98	0.98	0.97
RFI	0.92	0.91	0.92	0.91
Parsimonious fit indices				
PGFI	0.65	0.62	0.62	0.63
PNFI	0.71	0.68	0.68	0.69
Number of significant paths	4/6	3/6	3/6	3/6

6.6 Hypothesis testing

After adopting the best model (the originally proposed Model C) shown in Figure 6.6, the relationships with respect to Hypotheses 2 and 3 were tested (Section 3.3). The estimated path coefficients in Model C are given in Table 6.10. These estimated coefficients showed the relative importance of individual exogenous variables as they influenced risk perception and in turn purchase likelihood. Apart from 'price discount' and 'post purchase control', the effect of other risk reducing strategies on risk perception and the effect of risk perception on purchase likelihood were confirmed. The relationships between these factors were supported at the 0.05 significance level. Moreover, the relationship between brand and risk perception, and risk perception and purchase likelihood were supported at the 0.01 significance level. There was no evidence to support the relationship between 'post purchase control' and risk perception, and 'price discount' and risk perception.

Figure 6.6 Path Diagram of the Adopted Model (Model C) for Risk Reduction in Consumer Food Purchase

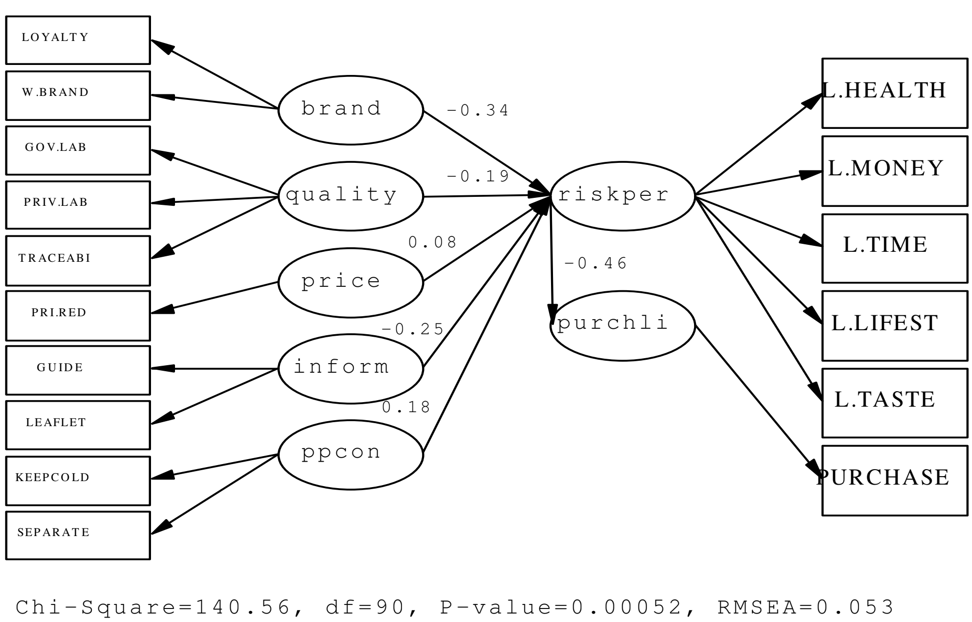


Table 6.10 Effects of Risk Reductions to Risk Perception and Purchase Likelihood (Based on Model C)

		To	
Hypotheses	**From**	**Risk Perception**	**Purchase Likelihood**
	Risk Reduction		
3a	brand	-0.34 (-3.39**)	0.16 (3.14**)
3b	information	-0.25 (-2.42*)	0.12 (2.30*)
3c	quality assurance	-0.19 (-2.11*)	0.09 (2.04*)
3d	post purchase control	0.18 (1.82)	-0.09 (-1.76)
3e	price discount	0.08 (1.29)	-0.04 (-1.26)
2	**Risk Perception**	---	-0.46 (-8.07**)

Notes:
Figures indicated are path coefficient estimate and (t-value)
Significance level:
** $p \leq 0.01$
* $p \leq 0.05$

6.7 Discussion

The preceding analysis confirms a relationship between risk reduction, risk perception and purchase likelihood. These findings are consistent with other research in an uncertain purchase situation (Bauer, 1967; Mitchell and Greatorex, 1989). Three risk reducing strategies identified are consistent with previous research of perceived risk theory that help to reduce the risk of loss in order to facilitate the purchase (e.g. Cox, 1967b; Roselius, 1971; Pugh, 1990; Hugstad, Taylor and Bruce, 1987; Mitchell and Boustani, 1994; Viscusi and Evans, 1998). As expected, risk perception exerts a negative effect on purchase likelihood which is also in line with past research (e.g. Huang, 1993; Eom, 1994).

6.7.1 Risk Reducing Strategies and Risk Perception

Risk reducing strategies identified in this study include ‘brand’, ‘information’ and ‘quality assurance’. ‘Brand’ has the strongest influence, followed by ‘information’, and ‘quality assurance’. On the other hand, ‘post purchase control’ and ‘price discount’ do not appear to affect either risk perception or purchase likelihood with respect to food safety issues. They are discussed in turn:

6.7.1.1 Brand and Risk Perception

‘Brand’ (causal effect of -0.34) has the highest reducing effect on consumer risk perception. ‘Brand’ in general is the most effective risk reducing strategy adopted by consumers when a risk is perceived (e.g. Cunningham, 1967b; Sheth and Vekatesan, 1968; Roselius, 1971; Newman and Werbel, 1973; Hoover, Green and Saegert, 1978; Mitchell and Boustani, 1992). Well known, popular brands or retail outlets were commonly used during periods of concern about food safety because these gave consumers some reassurance in terms of quality. Respondents from the exploratory interview said that they had confidence in a well-known brand or store which represented a high standard of quality. In this aspect, they perceived that those products might be free from any defect or potential harm. This is also in line with the recommendation of the poultry processing companies from the industry survey that brand adds value to chicken products in the eyes of consumer.

Consumers often rely on brands to communicate quality (Shapiro, 1973). No doubt, brand can provide unique emotional and functional benefits for the consumers, though it requires that a clear benefit such as the food product has with high quality and is safe to eat is communicated (Economist, 1999). Curlo (1999) points out that consumers in particular favour the brands sold by manufacturers with a good track record for quality. Consumers are very often faithful to a brand that has provided satisfaction in the past (Jacoby and Kyner, 1973; Yavas, Verhage and Green, 1992). They are less inclined to change to that which they had never tried before, in particular if the food product is not guaranteed for quality.

6.7.1.2 Information and Risk Perception

'Information' (causal effect of -0.25) has the second highest reducing effect on consumer risk perception especially if the consequence of purchase is uncertain (Hugstad, Taylor and Bruce, 1973; Mitchell and Vassos, 1997). Both qualitative and quantitative studies reported that consumers are eager to obtain information. The respondents pointed out that they would look for information if they were not certain about the product in relation to health impacts. This finding is consistent with the existing theory that consumers seek information actively or passively about products in order to reduce perceived risk (e.g. Bauer, 1967; Roselius, 1971; Pugh, 1990).

In general, information provides confidence in product choice (Cox, 1967b). It removes the fear of uncertainty during food scares if clear information on how to control the food hazard is provided (Slovic, 1986; Fischhoff, 1995; Yee and Yeung, 2002). Collecting information is one way of reducing perceived risk in consumer markets (Selnes, 1998), though the source and type of information needed may be different for different circumstances. The link between information and perceived risk partly depends on the product category and the consequence of risk (Cox, 1967b; Taylor, 1974). Regarding food safety related risk, reading in-store leaflets for product information and consumer guides for food storage and cooking instruction were perceived to be more useful than seeking advice from family or friends. Alternatively, respondents found that guidelines for cooking and storage printed on the package were easier to follow than printed on a separate sheet. With respect to the content of information, apart from cooking and storage instructions, a few respondents also appreciated extra information of the farm from where the chicken reared, the food preparation processes and the hygiene standard of the store.

6.7.1.3 Quality Assurance and Risk Perception

Quality assurance (causal effect of -0.19) has a moderate negative effect on consumer risk perception. The model confirmed that chicken products tested by government or independent laboratory or traced to the original farm are forms of quality assurance. As shown by the qualitative study, respondents believed that testing systems or traceability schemes provide a kind of guarantee, although consumers are often unfamiliar as to how they worked. The testing systems identified by this study match with past research and showed that government testing is one of the favoured risk reducing strategies for risk with hazardous loss (Roselius, 1971). Traceability schemes have been widely introduced by the food industry in the wake of the BSE crisis to show that meat comes from farms adopting best practices (Whitworth and Simpson, 1997). For instance, the source of food supply such as country of origin has been proved significant for quality perception (Thorelli, Lim and Ye, 1989).

Doubtless, consumers look for quality assurance product during periods of food safety concern. It is clear that consumers will have greater confidence in consuming chicken if the poultry industry labels products with a quality mark, logo or symbol with supporting information explaining what the label represents. This would serve to reinforce the beneficial effects of quality assurance on consumer risk perception.

6.7.1.4 Post-Purchase Control and Risk Perception

As suggested in the previous section, there is no evidence to indicate a relationship between 'post-purchase control' and consumer risk perception or purchase likelihood. 'Post-purchase control' in this study referred to personal responsibility for keeping the food safe after purchase, such as keeping chicken meat in a fridge or freezer after purchase and separating raw chicken meat from cooked meat. Though past research has estimated that 60 per cent of food poisoning incidents occurred in home, many people believe that home is the least likely source of food safety problems (Miles, Braxton and Frewer, 1999).

Consumers often perceived that the responsibility for uncontaminated food falls on the food industry and they often blame food manufacturers and food processing plants when things go wrong (Worsfold and Griffith, 1997). In other words, although consumers express a willingness to keep food safe, they perceive that the source of food risk arises before their purchase. They also perceive that the post purchase control by simply following proper procedure of keeping the chicken meat does not work if there are already pathogens in the chicken meat.

6.7.1.5 Price Discount and Risk Perception

'Price' does not show a significant effect on consumer risk perception. Both the qualitative and quantitative studies gave inconclusive results. Some of the respondents from the qualitative study mentioned that they were willing to pay a little extra for premium food such as free-range chicken. However, some had an opposite view and commented that they did not feel confident to associate high priced organic food with high quality. Likewise, some respondents favoured special offers to set against the food risk; however, some were unlikely to take the risk in return for a lower price. An inconclusive result of price-quality relationship on the purchase is also found in past research (Monroe, 1973). Similarly, there has been controversy in previous research as product quality seems to be associated with increased price paid, however little reduction in quality of high price product are associated with high disappointment from consumers (Bettman, 1973b). Bettman (1973a) suggests that the effect of price on consumer risk perception, whether premium price or discounted price, becomes less important if risk is high. Some of the respondents argued that price does not indicate whether the chicken meat product is safe to eat or not during the period of food safety concern. Despite the facts, further research is recommended to test the effect of price on consumer food choice in periods of concern about food safety.

6.7.2 Risk Perception and Purchase Likelihood

With the adoption of risk reducing strategies, consumer risk perception has a moderate negative effect (causal effect of -0.46) on purchase likelihood. Caution is required over interpretation since the effects of risk characteristics were kept constant in the analysis. This shows the impact of adopting the risk reducing strategies on the consumer risk perception and subsequently on the purchase likelihood. Purchase likelihood in this study was in the form of categories of behaviour, namely: continue to purchase, delayed purchase after one month, three months or six months weighted in order to reflect intentions of purchase. Risk perception in Model C comprised the same components, namely health loss, money loss, time loss, lifestyle loss and taste loss, as in the adopted Model B reported in Chapter 5. Again, the factor loading of the first four components showed that these types of consequent loss are perceived to be very important to the consumers.

Consumer risk perception is shown as a mediator linking risk reducing strategies and purchase likelihood. This matches with the existing theory that the latter would be adversely affected once a risk is perceived (Taylor, 1974), and the perceived risk could be relieved by a variety of risk reducing strategies (Roselius, 1971). As previously mentioned, three main types of risk reducing strategies were found relevant to reduce the perceived food risk that subsequently facilitates the food purchase with respect to microbiological hazards in chicken meat.

6.8 Summary of the Chapter

This chapter applied an analytical framework to assess the link between risk reduction, risk perception and purchase likelihood with respect to food safety related risk. The results from the assessment of linkage on microbiological hazards in chicken meat have been presented and discussed (hypotheses 2 and 3). The following conclusion can be drawn:

- The Structural Equation Modelling proved successful in identifying the risk reducing strategies which affect consumer risk perception and the subsequent purchase. The effects of individual risk reducing strategies on risk perception and on purchase likelihood were determined by assuming constant effect of risk characteristics on consumer risk perception.

- A consumer food purchase model was built to assess the direct and indirect effects of risk reduction on risk perception and purchase likelihood respectively. The model provided a framework to measure how consumers' subsequent purchase was influenced by modifications to consumer perception of risk due to the adoption of risk reducing strategies.

- Each risk reducing strategy has an individual effect on consumer risk perception. For instance, brands demonstrate the strongest influence on risk perception, followed by information seeking and quality assurance. Price discount and post-purchase control, however, do not show a significant effect on consumer risk perception.

- Consumer perception of food safety related risk was reduced by the perceived ability to adopt risk reducing strategies, in turn, shaping purchase likelihood. Consumer risk perception was measured in terms of health, finance, time, lifestyle, and taste losses with respect to microbiological hazards in chicken meat.

- Purchase likelihood was clearly seen to be dependent on how consumers perceived a food risk, and the extent to which they perceived that they could adopt strategies to reduce the exposure to risk in times of concern about food safety. Alternately, these risk reducing strategies also exerted an effect on purchase likelihood negatively through consumer perceived risk.

Having completed the analysis of the results of the present study, the following chapter focuses on the general implications and recommendations emerging from this research.

CHAPTER SEVEN

7. CONCLUSIONS, IMPLICATIONS, CONTRIBUTION, LIMITATION AND RECOMMENDATIONS

Following an overview of the aim and approach of the present study, this chapter contains the conclusions and implications for the government and food industry emerging from the research. Recommendations for further study are also discussed.

7.1 Summary of Study of Consumer Risk Perception

High profile food safety incidents associated with *BSE*, food poisoning bacteria, and chemical residuals in food in the UK consumption. As fresh chicken meat products are a favourite food product accounting for 40 percent of all meat eaten in 2000, this study focused on chicken meat. Because of recent contaminated feed and intensive production and processing methods, these cause most consumers concern about the hygiene standard in raw chicken meats, the highest among all raw meats. In turn, these concerns highly affect consumer risk perception. Consumer risk perception has been proved to have a key impact on purchase behaviour during periods of concern about food safety in other food research while the former may be influenced by the characteristics of food risk and the method adopted to reduce the exposure of risk. The effects of these factors are not well understood. In this context, the present study explored the link between the characteristics of food safety related risk, consumer risk perception and purchase likelihood. Likewise, strategies adopted by consumers to reduce the exposure to perceived risk were also examined.

After an extensive literature review, three hypotheses linking risk characteristics or risk reduction with consumer risk perception and purchase likelihood were used to guide the research:

Hypothesis 1:

There is a causal relationship between food risk characteristics and consumer risk perception.

Hypothesis 2:

There is a negative relationship between consumer risk perception and purchase likelihood.

Hypothesis 3:

There is a negative relationship between risk reduction and consumer risk perception.

Variables of perceived risk and the ways consumers used to reduce the exposure of risk were also elicited through face-to-face interviews with 28 respondents. The findings were used in designing a questionnaire for a subsequent survey with 200 respondents. The survey provided data for the testing of the hypotheses by applying LISREL 8.30 statistical package. Following these hypotheses, two consumer food purchase models by assuming constant effects from other factors were built with respect to food safety risk due to small sample size. Despite the limitation of presenting a single exhaustive model, these two models intend to help the food industry to identify appropriate risk management strategies and to guide resources allocation accordingly.

To test Hypothesis 1, the t-values of the six food risk characteristics identified from the model were checked. The results differ from previous research which has identified three groups of risk characteritistics. They indicated that consumer risk perception was indeed influenced by food risk characteristics either positively or negatively. The food risk characteristics which increase perception of risk included concern about safety and consequences, the degree of adverse effects, the influence of activists, the involuntariness of the exposure to risk and the uncontrollability of risk. Legislation and enforcement were shown to have a negative effect on consumer risk perception.

Hypothesis 2 was tested in a similar way. The result showed that there was a strong negative relationship between consumer risk perception and purchase likelihood. It suggested that the higher is the consumer risk perception, the less is the food purchase likelihood of the offending product during periods of concern about food safety.

To test Hypothesis 3, the risk reducing strategies identified from the model were examined. The result indicated that purchasing well-known brands, seeking product information and proof of quality assurance helped consumers to relieve perceived risks during the periods of concern about food safety.

7.2 Summary of Consumer Surveys

The overall results emerging from the study can be summarised as follows:

7.2.1 Food Hazards in Chicken Meat

This study has shown that microbiological hazard is considered to be a key concern of consumers associated with chicken meat consumption, alongside other food hazards such as chemical, technological and nutritional value hazards. It may be due to possible fatal consequences, microbiological hazards caused by bacteria such as *Salmonella* and *Campylobacter* affect consumer risk perception significantly. Consumers perceived the likeliness of an adverse effect on future generations and the environment if the food hazards continue unchecked, such as the increasing rate of the bacteria in chicken meat. These factors worry consumers and focus their attention on microbiological hazards. However, specific characteristics, namely knowledge and perceived own control of microbiological hazards help consumer confidence in the safety of chicken consumption even though these hazards still cause consumer most concern.

7.2.2 Food Risk Characteristics

This study found that food risk characteristics are the main causal factors of consumer risk perception during periods of concern about food safety. These food risk characteristics reflect the psychological qualities of risk that affect consumer risk perception as suggested by previous research. They explain the reasons why consumer perceived risk is often different from the view of scientists that is based on the technical probability of risk. This study also showed that each risk characteristic has its own individual effects on consumer risk perception.

As shown, the characteristics of food risk, namely: consumer concern about consequences of consuming contaminated food, adverse effects on future generation and environment, involuntary exposure to risk, the influence of activist movements and the perception of uncontrollable of risk serve to increase consumer perception of food risk. Following the findings from previous research in kind, the result is expected and reasons can be explained. The increasing effect contributed by the factors on consumer risk perception may be due to the repeated fatal incidents of food poisoning that have heightened consumer concern about the consequence. Consumers very often associate the uncertain adverse effects of a potential hazardous event to a long-term threat. Consumers consider a risk is harmful to health and their food choice is jeopardised if they are not well informed. Media reports on activist movements draw public attention to the hazard. Consumers risk perceptions increase if they perceived that the risk is inadequately controlled especially as the number of incidents has tended to increase in recent years. But the proper implementation of legislation can modify consumer perception of risk.

Two characteristics of risk namely perceived knowledge and personal own control of the food risk were emerged from this study to have a direct positive effect on purchase likelihood. The positive effects of these characteristics on purchase likelihood may be particularly relevant associated with the case of microbiological hazard such as *Salmonella* since consumers know that bacteria can be killed by cooking well and they can control the risk by their own effort. This shows that a definite and effective solution in controlling a food hazard can give consumers confidence in food consumption. As a result, the knowledge of proper cooking procedure to control the food hazard does not discourage food purchase, and may help to offset the negative effects of other factors.

7.2.3 Perceived Risk Theory

This study shows that the framework of the perceived risk theory applied in the context of consumer purchase behaviour is relevant to food safety related risk. Consumers perceived potential personal losses in terms of health, time, finance, lifestyle and taste losses if they consumed contaminated chicken meat. The consequences of these losses are comparatively significant and have a short term or long term effect on their personal health or welfare. As expected, because of these perceived consequence losses, consumer purchase behaviour is shaped to avoid the exposure of the food risk. Therefore, a negative relationship between consumer perceived risk and purchase likelihood was shown in the result.

7.2.4 Risk Reducing Strategies

This study concluded that risk reducing strategies provide possible ways for the consumers to reduce their exposure of the perceived food risk. Purchasing branded products, seeking information from trusted sources and choosing food products with quality assurance were identified as risk reducing strategies in the case of microbiological hazards associated with potentially hazardous and harmful consequences. The relative effects of individual risk reducing strategies were determined by using LISREL 8.30.

Risk reducing strategies vary in their relative effectiveness to modify perceived risk. The results suggest that the use of branded products is the most effective strategy because it provides a perception of a high quality product because consumers may feel peace of mind in the consumption of branded chicken products. Seeking product information is the second most effective strategy of which consumers may find help to judge and choose safe food for consumption. Besides, the information of storage instruction and proper cooking procedures also help consumers to keep the food in accordance with good hygiene standards. Quality assurance is the third most effective means of reducing perceived risk because it gives evidence of traceability and a message that food is free from food hazard.

7.2.5 Purchase Likelihood

This study agreed with other studies of consumer purchase behaviour that consumer food purchase is discouraged if a risk is perceived in food consumption. From the survey, consumers reported intent to reduce the purchase according to the level of perceived risk. A set of risk reducing strategies was found to help to relieve the perceived risk and thereby affect the purchase likelihood. Consumer purchases likelihood was likely to be increased if one or more risk reducing strategies are adopted.

7.2.6 Consumer Food Purchase Models

This study confirmed that the complexity of consumer risk perception is as much dependent on psychological factors as on the hazard themselves. It also demonstrated that it is possible to assess the links between the risk characteristics, risk reduction, risk perception and purchase likelihood with respect to food safety related risk by combining the psychometric factors and the perceived risk theory applied in the context of food safety and consumer purchase behaviour. Apart from the limitation of using a sophisticated statistical package explained in Section 7.6, the qualitative and quantitative approach proved to be useful for the purposes of the present study. The former elicited the terminology used in perceived food safety related risk. The latter identified the relevant items and factors in the relationship between the food risk and purchase likelihood.

By using Structural Equation Modelling (SEM), a model in identifying the food risk characteristics (Model B) and another model in identifying risk reducing strategies (Model C) that affect consumer risk perception, and in turn influence the food purchase, were developed. Though taking risk characteristics and risk reduction into a single model may make the analysis clearer than two models; this could not be worked out due to restricted resource. These two empirical models proved to be capable to identify the main factors of risk characteristics and risk reducing strategies for each individual food hazard. Microbiological hazards were used as example to determine their effects on consumer risk perception and subsequently on purchase likelihood.

As a pioneer study for the case of microbiological hazards in chicken meat, consumer risk perception was found to be affected mainly by concern about the severity of consequences, the uncertain adverse effect on future generations and environment, the involuntary exposure to risk, the influence of activist movement, legislation, and the uncontrollable risk. However, the risk reducing strategies such as purchasing branded product, seeking product information and choosing products with quality assurance can relieve consumer perceived risk. Apart from risk perception, perceived knowledge and own control have been discovered to influence consumer purchase behaviour in different ways.

7.3 Industrial Consultation

In order to provide a reference point for the consumer survey, open-ended questions were sent to 15 companies from the poultry industry in order to review how they perceive and respond to reduce consumer perceived microbiological risk in chicken meat. This helps to interpret the implications of the study for the food industry.

Six replies were received. Their answers were summarised under the following four sections, namely importance of consumer perceived risk to food industry, influential factors to consumer risk perception, risk reducing strategies adopted by consumers, and methods to reduce perceived risk and restore consumer confidence.

7.3.1 Importance of Consumer Perceived Risk to Poultry Industry

Five out of six respondents supported that consumer perception of exposure to food safety related risk was higher than the actual exposure. The respondents pointed out that one of the main reasons was because of the wide media coverage of the negative events. In contrast, one respondent commented that many food poisoning incidences occurred at home because of consumers' low knowledge in kitchen hygiene. This revealed the existence of an actual risk.

Half of the respondents admitted that in general consumer purchase behaviour was influenced by the perceived risk associated with food safety. Sales were indeed affected after media reports of major events, such as the contamination of animal feed in Belgium. They also found that there was a shift of purchase from a whole raw chicken to ready-made meals with smaller portions for immediate consumption.

These findings supported the importance of consumer perceived risk for the food industry. If consumers perceive a risk about a product, such as a possible harmful consequence to humans caused by the overuse of antibiotics on farms, there is likely to be a decline in demand for that particular product. Industry respondents thought that this was an unnecessary loss of demand because of higher perceived risk than the actual risk.

7.3.2 Influential Factors to Consumer Risk Perception

Respondents suggested the following factors which have positive or negative influences on consumer risk perception.

7.3.2.1 Media Attention

As discussed previously, consumer risk perception was mainly influenced by media, especially some reports did not reflect the facts. These reports served to amplify the food scare and not only heightened the concern of the food risk but also reduced the confidence of the food consumption. Industrial respondents argued that because consumers were not aware of the extent to which media amplified the reporting of risk, the more was the media coverage and the higher was the consumer perceived risk.

7.3.2.2 Incident History

Industrial respondents found that consumers associated *Salmonella* in chicken with the outbreak of *Salmonella* in eggs in the past. Subsequently, the incidents of *Salmonella* in eggs were translated into caution about chicken consumption.

7.3.2.3 Intensive Production

Industrial respondents commented that consumers were aware of various breeding methods, however, they categorised all indoor breeding methods as intensive production. Because of the confined environment for rearing chickens, consumers perceived all indoor chickens to be of higher microbiological and chemical risk than outdoor free range chickens.

7.3.2.4 Self-confidence

The respondents contended that self-confidence in cooking raw meat was another factor influencing consumer risk perception. In their view, although consumers very often have self-confidence in cooking, they may not adopt safe practices. This was a main reason why many food poisoning incidents happened at home. Because of this frequent incidence, consumer perceived risk has increased.

7.3.3 Risk Reducing Strategies Adopted by Consumers

Industrial respondents reported that consumers usually adopted or should adopt the following risk reducing strategies. The first strategy referred to reducing the purchase to ease a risky situation. The next strategy related to absorbing the unresolved risk partly or fully by buying branded products and handling chicken meat properly. These findings were consistent with the other research, and both qualitative and quantitative consumer surveys.

7.3.3.1 Reduction in Purchase

The industrial respondents found that reducing purchases was the immediate solution adopted with confidence by consumers in general if the consequences cannot be anticipated. The reduction of purchase was in terms of reducing the consumption of the offending product or shifting to purchase a perceived safer product, such as cooked chicken portions when there was an outbreak of food risk.

7.3.3.2 Branded Product

The industrial respondents reported that purchasing branded product was another option very often used by consumers. They suggested that the brand could provide an image of added value and quality assurance, especially when the products were under a trusted brand.

Furthermore, the branded ready meal product even acquired an extra character, that was to provide a guarantee of safety, which was based on an attribute of fully cooked quality. The respondents argued that branded fully cooked products were particularly useful for those consumers who lacked confidence in their ability to cook raw meat. This implication needs further research.

7.3.3.3 Kitchen Hygiene

Industrial respondents believed that proper kitchen techniques could avoid the cross contamination of cooked food from raw. They mentioned that proper handling and cooking of the raw meat by consumers could reduce both actual and perceived risk. They however stated that this risk reducing strategy was poorly adopted and falsely reduced the perceived risk if the consumers thought that they could control the risk by following closely to the cooking instruction.

7.3.4 Methods to Reduce Perceived Risk and Restore Consumer Confidence

In response to consumers concern, the food industry adopted methods to reduce perceived risk and to restore consumer confidence. The methods fall into two main categories, namely, maintaining a high quality standard in order to ensure food safety and providing information in order to address consumer concern.

Industrial respondents found that quality assurance from an independent organisation was one way to restore consumer confidence. Respondents were member of Assured Chicken Production (ACP) and British Poultry Council (BPC) in order to ensure their products conformed to high quality standard and to provide evidence of their tight control over all stages of production from farm through to processing.

Making use of the brand value, poultry processing companies reported that they often promoted the fully cooked nature of chicken products and a small portion for single use to consumers and the food press. This gave a guarantee of safety and provided consumer confidence in consumption for branded ready to eat products.

Regarding product or risk information, labelling was seen as a means of providing essential information such as handling, storage and cooking instruction. The expiry date also served as a guideline of safe period for consumption. The label on the packet would be convenient for the users' reference. Websites were another way to provide information. Information such as food risks, guidelines for food safety or kitchen hygiene was included. On top of this, respondents mentioned that they had opened consumer carelines in order to reply consumers' queries about the product in particular regarding food safety issues, on the other hand, listened directly to consumers of their concerns in order to follow closely to their needs.

The respondents commented that educating consumers about food hygiene was their aim. This would be achieved by promoting education programme on kitchen hygiene in schools. With the support of industry initiatives such as Food and Drink Federation, the awareness of food safety at home would be increased. Association with retailers and foodservice industry would also be help to promote food safety. In addition, they very often relied on the in-trade association to prepare press statements during periods of concern about food safety.

7.4 Implications for the Government and Food Industry

Consumer risk perception and its impacts on purchasing behaviour are seen to be critical to food safety issues as pointed out by the industrial respondents. Perception of consumers towards the safety of food during periods of concern needs to be addressed since it does affect the welfare of the whole society. Consumer risk management strategies clearly influence, and respond to, the risk management strategies adopted by the food industry. It is important, therefore for those risk communicators who are engaged in the operation and regulation of food supply chain, from farm to retail outlet, take account of how and why consumers perceive food safety risk. Otherwise the risk communication becomes distorted and misunderstood (Anderson, 1999). The food industry also needs to know how best to address these concerns in its risk management strategies.

Responses by the food industry could include segregating markets according to risk perception or behaviour. The industry could draw benefit from exploring how consumer perception of food safety risk varies in response to alternative marketing strategies such as product design relating to microbiological risk, promotions and communications (including methods to inform or persuade about risk), and distribution systems and logistics (including quality assurance and traceability). It seems that these marketing strategies are inter-related.

Certainly, brand is a good risk reliever; however, branding is rarely found in much of the primary meat sector (Euromonitor, 2000). During periods of concern about food safety, identities such as Welsh lamb, and Aberdeen Angus steaks, fresh meat producers can give a high quality image to consumers and allow them to have wider food choice. For instance, poultry processing companies argue that their branded products create added value and maintain consumer confidence. They have improved the product acceptance by designing small portions of cooked chicken meat in order to overcome the fear of *Salmonella* in raw meat. In this respect, fresh meat producers can position themselves by promoting a high standard of quality with assurance. Promotion can be made through advertising in magazine, newspaper, consumer guide or display at stores (Hugstad, Taylor and Bruce, 1987). The effects of marketing media may be different depending on the level of the perceived risk.

Poultry producers reported that they have spent huge sums on new equipment and vaccinating flocks to reduce actual risk. Likewise, perceived risk can be reduced by promoting the quality and safety related characteristics of their products. Many companies have a high advertising spending for this purpose alone and found that it was effective. (Mitchell and Boustani, 1993; Euromonitor, 2000). Undoubtedly, advertising could build up brand awareness, brand attitude and brand purchase intention where quality assurance is a key element of brand identity (Rossiter and Percy, 1987).

Information provision is especially important to both consumers and food industry during periods of concern about food safety. No doubt, there is room to improve the common welfare by providing information for wider food choice, in turn, to enhance the willingness to purchase. The information can be in form of labels showing storage guidelines, methods of reheating, specific handling instructions and even health information or food safety tips but the amount of information depends on the level of the perceived risk (Worsfold, 1995; Martin, 1997; Dulen, 1999; Thompson, 1999). The labels, such as quality marks are well received by consumers in particular if they are endorsed or recognised by an independent body, such as Food Standard Agency, or Meat and Livestock Commission with respect to the safety and wholesomeness of the food product (Beddall, 1997; Frost, Frank and Maibach, 1997; Rundmo and Sjoberg, 1998; Lindsay, 2000). Respondents in this study claimed to know how to control food hazard, they still commented on the confusion in food labels, marks or symbols of quality assurance. With respect to this, the use of graphics or diagrams with little text which is clear and easy to understand can help to improve the comprehensibility of the risk information (Connelly and Knuth, 1998). Apart from comprehensive labelling, a point of sale poster to describe the symbols and video show to explain how the system works in relation with traceability will also help (Henkel, 1998). Indeed, visual images with narration are much more easily comprehended.

Traceability and farm assurance schemes are found to be particularly relevant to maintain and restore consumer confidence provided that all parties of food supply chain follow the regulations (Watson, 2000a, 2000b). This requires the government and the food industry to demonstrate best practices all along the food supply chain to eliminate any food risk (Palmer, 1998). Certainly, specific legislation to control the procedures of monitoring systems can help to support the industry's claims for safe products (James, 1997). The enforcement of regulations indeed put rules into practice to meet food standards and give consumers confidence in the controllability of food hazard. The research reported here confirmed the importance to consumers of legislation and control as methods for enhancing consumer confidence in food safety.

Furthermore, knowledge about the food risk appears to be an important factor to consumer purchase decision. It is clear that consumers acquire their knowledge through those who regulate the food risk since the message of 'cooking well' is deeply set in consumers' minds (Yeung, 2001). Food safety campaigns run by organisation, such as Food and Drink Federation can successfully educate consumers the ways of good practices in the kitchen (Mintel, 1997). A leaflet with guidelines to reduce food poisoning printed and distributed by government is another successful example. However, warning about foodborne illnesses or serious consequences from food hazard is required because consumers very often have over-confidence with their perceived knowledge (Viscusi, 1991; Ellen, Bone and Stuart, 1998). Besides, the instructions on safe handling and cooking of raw meat and poultry, the nutrition guidelines on the package or cookbooks would also inform consumers of risk if they do not follow good practices (Teague and Anderson, 1995; Birchard, 1999).

To conclude, given that the overall marketing purpose is to build enduring, mutually beneficial relationships between suppliers and consumers, it is important that risk analysis and management adopt a whole supply chain perspective. Of course, risk management strategies need to match circumstances and purposes: whether ongoing maintenance of confidence in food safety, emergency response during food safety 'scares', or remedial confidence rebuilding in the aftermath of a food safety event. A good risk communication strategy focuses on those issues of greatest concern to consumers. It would be helpful if food industry and the government could provide the information to consumers on how they work to improve the safety standard in order to reduce the presence of bacteria in chicken meat together with evidence to prove the meat quality. The most effective and long-term solution is to inform and educate consumers about food risks with how to control them, as identified by this study of microbiological hazard in chicken meat. Knowledge creates the awareness of the food risk. Though it may not reduce consumer perception of the risk, it can, combined with knowledge and skills of food handling, storage and preparation, help to maintain consumer confidence in food safety and present positive impacts on purchase behaviour.

7.5 Contributions of the Study

The study makes a number of contributions to theory, methodology and practice. Regarding theory, the research help to link food risks and consumer purchase behaviour through risk characteristics, risk reduction and risk perception. The perceived risk theory commonly used in the context of consumer purchase behaviour was extended to include the psychometric factors identified in food safety risk. The elements of perceived consequent losses previously applied in a marketing context where products under-perform result in disappointing outcomes are shown to be relevant to products which are potentially harmful and hazardous to personal health during periods of food safety concern.

With respect to methodology, this study has demonstrated the use of Structural equation Modelling to develop empirical frameworks which help to explain and predict consumer purchase behaviour during periods of food safety concern. These frameworks help to understand the relationship between food risk characteristics, risk perception and purchase likelihood as well as risk reduction in the study of microbiological risk in chicken meat. These frameworks also provide estimates of total effects on purchase likelihood and individual effects of the causal factors.

Relating to practice, the identified risk characteristics and risk reducing strategies have the potential to help the government and food industry develop appropriate risk management strategies and effective risk communication message. The frameworks help to evaluate the risk management programme by comparing the total effect on the purchase likelihood before and after implementing a risk management plan. The empirical frameworks have the potential to apply to other food risks in chicken meat, such as chemical risk, technological risk and to other food sectors.

7.6 Limitation of the Study

Inevitably, there are a number of limitations of the research which is exploratory nature. These limitations mainly relate to the research design, namely: sample size, sampling method, data collection and data analysis of the qualitative and quantitative study. These limitations reflect constraints imposed by available resources,

- Sample Size. Owing to limited resources, only 200 respondents were selected for the quantitative study. Because of the relatively small samples, a single exhaustive model of consumer food purchase for including risk characteristics and risk reduction could not be obtained. In addition, previous research has shown a significant differences in risk perception among age, gender, education background, income level. There may be a possibility of differences in the purchase behaviour among these categories, however the result showed no statistically significant differences which may be due to small sample size.

- Sampling Method. A random sampling method was not used due to the limited resources. The study approach was using a 200 quota sample based on age. There could be bias in sample selection and responses might not necessarily be representative of attitudes in the UK as a whole. Generalisation of the result should be made with caution though it is considered that the results are indicative of general attitudes of consumers towards microbiological hazards in chicken meat.

- Data Collection. The informal interviews are inevitably subjective. There may be possibly biased such as, interviewer, interviewee, selection and interaction bias. Without the aid of tape recorder, the interview has followed closely a systematic procedure in order to avoid the possible biases and to collect good quality of data for the developing questionnaire in the subsequent survey. For the quantitative study, because of the time frame, this study adopted a cross-sectional approach that gives only a snap shot of consumer risk perception at a particular period in time. The models did not take into consideration how consumer risk perception is developed through time. The understanding of the development of consumer risk perception will help to analyse its impact on purchase behaviour.

- Data Analysis. As a result of the stringent requirement in adopting Structural Equation Modelling (SEM) for the statistical analysis, marginal items of risk characteristics, risk perception and risk reducing strategies may have been sacrificed in an attempt to achieve maximum reliability and validity. In this study, those items with loadings marginally below 0.71 were included, but later were removed because the consumer food purchase model could not be built by including these items into the factors when analysing by LISREL. Furthermore, several plausible models for consumer food purchase during periods of food safety concern arose through the analysis of SEM using LISREL 8.30. There is a possibility to tempt the researcher to adopt models which, giving marginally improved statistical fit, did not accord with the underlying theory. This study however, selected an empirically based model among these plausible models, which was supported by existing theories derived from literature review.

These limitations did not affect the quality of this study and recommendations addressing these issues are discussed in Section 7.7.

7.7 Recommendations for Future Research

From the above conclusions, it is possible to group for future research recommendations into three main types, namely: to address the shortcomings of the current study, to extend this work to other applications and to identify new areas of research of relevance to those in academics and industry.

7.7.1 Research Refinement

As discussed in the section of limitation, the quota sampling method used in this study did not represent the attitude of the UK population as a whole. This study provides a possible way for future research of its kind, though it may not be directly generalised to other food products, such as beef products, fruit or vegetable or other non-food sectors, such as environment risk. A large sample size for a single exhaustive model and random sampling method is suggested for future study.

The results derived here showed that age, gender, education, and social class have no significant difference in purchase likelihood among samples. Again, a larger sample size may help to validate whether different groups have different perception or behave differently towards food safety risk.

In order to overcome the snap shot of consumer risk perception on microbiological hazard based on a cross-sectional approach, a longitudinal study is recommended to give a clearer picture of how the risk perception develops over time. Changing household structures, such as people living alone or with dependants, and the patterns of work may influence their perception of food risk. Future work also needs to inquire into the relationship between personality, attitude, motivation, ability and lifestyle with risk perception and purchase behaviour.

Theoretically, perceived knowledge and own control are two of the risk characteristics that affect consumer risk perception. It is interesting that they emerged from this study as factors which maintain the food purchase rather than influence risk perception. These findings can be comprehended in the case of microbiological hazard in chicken meat. As discussed previously, consumers know that they can control the food risk, though they are aware of the severe consequence of the food risk. In other words, they do not perceive less risk in chicken meat, but they keep purchasing because of the definite solution to overcome the risk by cooking well. These findings have not been evident in other research. This difference requires more empirical research.

7.7.2 Research Extension

The use of SEM, a sophisticated statistical technique, helps to identify causal factors of consumer risk perception for each individual food hazard. This study focused on microbiological hazards. Doubtless, the nature of these hazards may differ from other types of food hazard. Microbiological hazards may arise due to the action of different parties. In particular, consumers themselves may be responsible for the safety of the food they consume. A good and definite solution such as ‘cooking well’ to control microbiological hazard has been provided by the government and food industry. ‘Own control’ is therefore identified to be one of the main risk characteristics of microbiological hazards, but this may not be applied to other hazards. For other food hazards such as chemical hazards, the source of risk arises mainly during food production or food processing and this cannot be reduced by consumers’ own control. The developed methodology however, is likely to be helpful to assess consumer risk perception of other risk types, such as GM ingredients fed to chicken. It is recommended to develop further definition of risk characteristics for other types of food hazard using the SEM methodology developed in this study.

This study was conducted in the UK. Cross-national research, that is, a research carried out simultaneously in other countries, such as France and Spain is recommended. This will enable a comparison of any cultural differences since consumer perception of risk and purchase behaviour may vary across cultures. This cross-national research can also test the applicability of the consumer food purchase models among other nations.

Further research is suggested to include investigating how situational factors such as type of food for regular meal or special occasions influence consumer risk perception and purchase behaviour. For example, consumers may spend more on quality assured food for special occasions to avoid embarrassment before family or friends if they perceive social loss as an important factor. In this case, measurements of perceived loss may be varied from the model linked with risk reduction; a new set of risk reducing strategies may be developed. Other research reports that there is inconsistency between consumers' claims and actions. This issue warrants further investigation.

7.7.3 Other Academic and Industrial Research

In this study, the finding of eight characteristics of food risk is inconsistent with previous research that warrants further investigation. Branded products and products with quality assurance were identified to be effective to reduce perceived risk from both consumers and industrial respondents. Endorsement from independent organisation was found particularly useful with respect to food safety related risk. From the consumer survey, respondents seemed to be confused about the symbols and quality marks supported by different organisations. Future research is required to help determine the best way to put through the message of these quality marks to consumers.

The use of pricing factor was shown to be ineffective and potentially damaging way of encouraging consumer purchase during period of food safety concern. There is always controversy about price in other research of consumer purchase. High priced free-range chicken is perceived to have high quality in some studies on food risk. On the other hand, price reduction is used by the food industry to encourage sales of offending products during periods of food safety concern. In this context, pricing strategies need further research.

In the same way, post purchase control such as separate the cooked meat from the raw meat was identified by the qualitative study, but it was not confirmed by the formal quantitative survey. In other words, consumers did not perceive that the risk occurs at home and the responsibility is on the food industry. But from the industrial perspective, proper kitchen hygiene was seen to be important to reduce food risks. On this point, there is an information gap between consumers and the food industry. Future study is required by the food industry to find out effective ways to communicate to and educate consumers.

The developed methodology helps to determine the effects of individual factors on consumer risk perception and purchase likelihood by providing the estimated relative effect of each factor. However, the steps to be taken by the regulator or food industry in response to these factors still remain unexplored. For instance, 'adequate' regulation and enforcement were found helpful to modify consumer risk perception. An in-depth research is recommended to investigate what 'adequate' means, and what type of regulation and enforcement do consumers perceive appropriate. Likewise, information was identified to be important to reduce perceived risk by consumers and by the poultry industry. But what type and quantity of information required by consumers to support informed food choice and which communication channels are most effective are important questions for further research.

The models of this study provide frameworks for assessing consumer purchase likelihood during the periods of concern about food safety. The models link risk characteristics, risk reducing strategies, risk perception with purchase likelihood. This study has identified the causal factors to affect consumer perceived risk and further study is recommended to apply the findings to bring the perceived risk consistent with the actual risk. The frameworks also serve as a basis for development of effective risk management and risk communication strategies for given circumstances. For instance, the channels of risk communication, such as consumer care lines, food safety websites, and so forth mentioned by the industrial respondents are in need of investigation. It is also apparent that food safety related risk management should be fully integrated in the marketing mix. In this respect, the implications of these strategies in product design, price, distribution and promotion, require further research.

Estimate of individual effects of each risk characteristics, risk reduction and consumer risk perception on purchase likelihood given by the models help the government and food industry to evaluate the effectiveness of the risk management strategies during and post-periods of concern about food safety. Further research on the changes of consumer risk perception during and/or post-incidence of food scares is necessary if the regulator and the food industry are indeed careful upon the food risk. An industrial focused research on how the food industry should respond to consumer risk perception during periods of concern about food safety and how and in what way industry can promote post-purchase food safety by consumers is recommended for future study.

7.8 Closing Statement

This exploratory study has achieved what it set out to do. The research confirmed the importance of consumer risk perception during periods of concern about food safety since it has a substantial impact on purchase likelihood. Consumer perceptions of food safety have important implications for informed food choice and consumer welfare, and for the effectiveness and efficiency of the food industry that is responding to consumer needs. The research also confirmed that consumer risk perception is influenced by the risk characteristics and the risk reducing strategies adopted by consumers. It concludes that this is a valid topic for further research and will provide potential benefits for consumers and the food industry as a whole.

References

Agrawal, M. (1995), "Warning labels: The role of expertise and perceived risk in pharmaceutical purchase behaviour", *Health Marketing Quarterly,* New York, Vol. 13 Issue 2, pp. 99-108.

Ahmad, J. (1995), "Food irradiation - facts and fiction", *Nutrition & Food Science,* Vol 95 Issue 3.

Ali, H. (1997), Risk & Trust in New Venture Marketing, *Unpublished PhD thesis, University of London.*

Anderson, W. (1999), "Risk analysis: fear, perception and reality", *Royal Irish Academy*. Food Safety Authority of Ireland, www.fsai.ie/fsai_papers/210499.htm

Andereson, J. C. and Gerbing, D. W. (1988), "Structural modelling in practice: a review and recommended two-step approach", *Psychological Bulletin,* Vol. 103 No. 3, pp. 411-23.

Arndt, J. (1967), Word of Mouth Advertising and Information Communications, in Cox D. (ed.), *Risk Taking & Information Handling in Consumer Behaviour,* Graduate School of Business Administration, Harvard University, Boston, pp.188-239.

Attenborough, M. and Matthews, K. R. (2000), "Food safety through the meat supply chain", *Journal of Applied Microbiology*, Symposium Supplement, The Society for Applied Microbiology, Vol. 88, pp. 144S-148S.

Babakus, E., Cravens, D., Johnston, M. and Moncrief, W. (1999), "The role of emotional exhaustion in sales force attitude and behaviour relationships", *Journal of the Academy of Marketing Science*, Vol. 27 Issue 1, p. 58.

Bagozzi, R. P. (1981), "An examination of the validity of two models of attitude", *Multivariate Behaviour Research,* Vol. 16, pp. 323-59.

Bagozzi, R. P. (1994), Structural equation models: basic principles in Bagozzi, R. P. (ed.), *Principles of Marketing Research*, Blackwell Business.

Bagozzi, R. P. and Baumgartner, H. (1994), The evaluation of structural equation models and hypothesis testing in Bagozzi, R. P. (ed.), *Principles of Marketing Research*, Blackwell Business.

Bagozzi, R. P. and Fornell, C. (1982), Theoretical concepts, measurements and meaning in Fornell, C. (ed.), *A Second Generation of Multivariate Analysis,* Praeger.

Bagozzi, R. P. and Philips, L. W. (1982), "Representing and testing organisational theories", *Administrative Science Quarterly*, Vol. 27 No. 3, pp. 459-489.

Banatvala, N., Cramp, A., Jones, I.R and Feldman, R. A. (1999), "*Salmonellosis* in North Thames, U K: associated risk factors", *Epidemiol Infect*, Vol. 122 No. 2, pp. 201-207.

Barboza, D. (1999), "Biotech companies take on critics of gene-altered food", *New York Times,* New York, 12 November, 1999.

Bates, S. (1999), "US rejects EU pork and poultry", *The Guardian,* 5 June, 1999.

Bauer, R. A. (1967), Consumer behaviour as risk taking, in Cox D F (ed.), *Risk Taking & Information Handling in Consumer Behaviour,* Graduate School of Business Administration, Harvard University, Boston, pp. 23-33.

Bayliss, P. (1995), "Chemistry in the kitchen: the chemistry of flesh foods IV", *Nutrition and Food Science,* Vol. 95 Issue 6.

BBC (2000), "Children 'catch *Salmonella*' in chick project", *British Broadcast Corporation*, 20 April.

Beddall, C. (1997), "What would the Liberal Democrats do?" *The Grocer,* Vol. 219 No.7298 p.12.

Beecham, L. (2000), "Food Standards Agency will be open and independent", *British Medical Journal*, Vol. 320 No. 7238, pp. 826-827.

Bender, A. (1986), Food and Nutrition, in Ritson, C., Gofton, L. and McKenzie, J. (ed.), *The Food Consumer*, John Wiley & Sons Ltd., pp. 37-58.

Bentler, P.M. (1980), "Multivariate analysis with latent variables: causal modeling", *Annual Review of Psychology*, Vol. 31, pp. 419-456.

Bettman, J. R. (1973a), "Perceived risk and its components: a model and empirical test", *Journal of Marketing Research,* Vol. 10, pp. 184-90.

Bettman, J.R. (1973b), "Perceived price and product perceptual variables", *Journal of Marketing Research*, Vol. 10, February, pp. 100-102.

Birchard, K. (1999), "New European Commissioner for food safety stamps his authority," *The Lancet*, London, Vol. 354 Issue 9183, pp. 1012-1014.

Board, R. G. (1983), *A Modern Introduction in Food Microbiology*, Blackwell Scientific Publications, London.

Bollen, K. and Long, J. S. (1992), "Tests for structural equation models: introduction", *Sociological Methods and Research,* Vol. 21, Nov, pp. 123-31.
Booth, J. (2000), "Update on outbreak of *Salmonella enteriditis* phage type 5c", *Food Standards Agency, Scotland*, 1 September, 2000.

Bostrom, A., Fischhoff, B. and Morgan, G. M. (1992), "Characterizing mental models of hazardous process: a methodology and an application to radon", *Journal of Social Issues*, Vol. 48 No. 4, pp. 85-100.

Braus, P. (1994), "Everyday fears", *American Demographics*, Ithaca, Vol. 16 Issue 12, pp. 32-40.

Breckler, S. J. (1990), "Applications of covariance structure modelling in psychology: causes for concern", *Psychological Bulletin*, Vol. 107 No.2, pp. 260-273.

Burger, J., Kennamer, R., Brisbin, I. and Gochfeld, M. (1998), "A risk assessment for consumers of mourning doves", *Risk Analysis*, Vol. 18 No. 5, pp. 563-573.

Burton, S., Garreston, J. and Velliquette, A. (1999), "Implications of accurate usage of nutrition facts panel information for food product evaluations and purchase intentions", *Academy of Marketing Science Journal*, Vol. 27 Issue 4, pp. 470-480.

Burton, M., Tomlinson, M. and Young, T. (1993), "The meat purchase decision", *British Food Journal*, Vol. 95 No. 8, pp. 13-17.

Cahill, S. (2000), Risk assessment of microbiological hazards in foods: an international approach, *Food and Nutrition*, Vol. 27, pp.20-25.

Calder, B. (1994), Qualitative Marketing Research in Bagozzi, R. P. (ed.), *Principles of Marketing Research*, Blackwell Business.

Caruana, A., Pitt, L. and Berthon, P. (1999), "Excellence-market orientation link: some consequences for service firms", *Journal of Business Research*, Vol. 44 Issue 1, pp. 5.

Casley, D. J. and Kumar, K. (1992), *The Collection, Analysis, and Use of Monitoring and Evaluation Data*, The Johns Hopkins University Press, Baltimore and London.

CDC (2000), "Antibiotic Resistance", *Center for Disease Control and Prevention*, Division of Bacterial and Mycotic Diseases.

CDR (1996), "Notifications of infectious diseases", *Communicable Disease Report*, CDR Weekly, Vol. 6 No. 2, p. 13.

CDR (2001), "Notifications of infectious diseases", *Communicable Disease Report*, CDR Weekly, Vol. 6 No. 2, p. 13.

Chae, M and Hill, J. (2000), "Determinants and benefits of global strategic marketing planning formality", *International Marketing Review*, Volume 17 No. 6.

Cheng, E. W. L. (2001), "SEM being more effective than multiple regression in parsimonious model testing for management development research", *Journal of Management Development*, Vol. 20 No. 7, pp. 650-667.

Chisnall, P. (1992), *Marketing Research*, McGraw-Hill Book Co., London.

Chipman, H., Kendall, P., Auld, G. Slater, M. and Keefe, T. (1995), "Consumer reaction to a risk/benefit/option message about agricultural chemicals in the food supply", *The Journal of Consumer Affairs,* Vol. 29 No. 1, pp. 144-149.

Churchill, G. A., Jr. (1979), "A paradigm for developing better measures of marketing constructs", *Journal of Marketing Research,* Vol. 16, pp.64-73.

Clarke, J. and Moran, A. (1995), "An investigation into the current market for fruit in the UK and the measures taken to promote an increase in consumer consumption", *Nutrition & Food Science,* Vol. 95 Issue 6.

Collins, E. and Oddy, D. (1998), "The centenary of the British Food Journal, 1899-1999 - changing issues in food safety regulation and nutrition", *British Food Journal,* Vol. 100 No. 10-11, pp. 436-550.

Connelly, N. A. and Knuth, B. (1998), "Evaluation risk communication: examining target audience perceptions about four presentation formats for fish consumption health advisory information", *Risk Analysis*, Vol. 18 No. 5, pp. 649-659.

Conner, M. T. (1993), "Understanding determinants of food choice: contributions from attitude research", *British Food Journal*, Vol. 95 No. 9, pp. 27-31.

Cooper, D. R. and Emory, C. W. (1985), *Business Research Methods,* Irwin.

Covello, V. T. (1991), Risk Comparisons and Risk Communication, in Kasperson, R. E. and Stallen, P. M. (eds.) *Communicating Risks to the Public: International Perspectives*, Kluwer Academic Publishers, Netherlands.

Covello, V. T., and Mumpower, J. (1985), "Risk analysis and risk management: an historical perspective", *Risk Analysis*, Vol. 5 No.2, pp. 103-120.

Covello, V. T., Sandman, P. M. and Slovic, P. (1988), *Risk Communication, Risk Statistics, and Risk Comparisons: A Manual for Plant Managers*, Washington, D.C.: Chemical Manufacturers Association.

Cowden, J.M., Lynch, D., Joseph, C.A., O'Mahony, M., Mawer, S.L., Rowe, B. and Bartlett, C.L. (1989), "Case-control study of infections with *Salmonella enteritidis* phage type 4 in England", *British Medical Journal*, Vol. 299 No. 6702, pp. 771-773.

Cox, D. F. (1967a), Risk handling in consumer behaviour – an intensive study of two cases in Cox, D. F. (ed.), *Risk Taking and Information Handling in Consumer Behaviour,* MA: Harvard University Press, Boston, 1967, pp. 34-81.

Cox, D. F. (1967b), Introduction, in Cox, D. F. (ed.), *Risk Taking and Information Handling in Consumer Behaviour*, MA: Harvard University Press, Boston, PP. 1-19.

Cox D. F. (1967c), The Audience as Communicators, in Cox D. F. (ed.), *Risk Taking & Information Handling in Consumer Behaviour,* Graduate School of Business Administration, Harvard University, Boston, pp. 172-187

Cragg (2000), *Qualitative Research to Explore Public Attitudes to Food Safety*, Report prepared for Food Standard Agency, Cragg Ross Dawson Ltd., London, UK.

Creswell, J. W. (1994), *Research Design: Qualitative and Quantitative Approaches*, Sage Publication.

Cunningham, S. M. (1967a), The major dimensions of perceived risk, in Cox, D. F. (ed.), *Risk Taking and Information Handling in Consumer Behaviour*, Boston, MA: Harvard University Press.

Cunningham, S. M. (1967b), Perceived risk and brand loyalty, in Cox, D. F. (ed.), *Risk Taking and Information Handling in Consumer Behaviour*, Boston, MA: Harvard University Press.

Cunningham, S. M. (1967c), Perceived Risk as a Factor in Information Communication, in Cox D. F. (ed.), *Risk Taking & Information Handling in Consumer Behaviour,* Graduate School of Business Administration, Harvard University Press.

Curlo, E. (1999), "Marketing strategy, product safety, and ethical factors in consumer choice", *Journal of Business Ethics*, Dordrecht, Vol. 21 Issue 1, pp. 37-48.

Daily, C. and Johnson, J. (1997), "Sources of CEO power and firm financial performance: a longitudinal assessment", *Journal of Management*, Vol. 23 No. 2, pp. 97-117.

Daily, C. (2002), Personal communication with the researcher.

Diamantopoulos, A. and Siguaw, J. A. (2000), *Introducing LISREL*, SAGE Publications, London.

Diamond, W. D. (1988), "The effect of probability and consequence levels on the focus of consumer judgements in risky situations", *Journal of Consumer Research,* Vol. 15 No. 2, pp. 280-283.

Dillon, W. R. and Goldstein, M. (1984), *Multivariate Analysis – Methods and Applications*, John Wiley & Sons, Inc.

Dillon, W. R., Madden, T. J. and Firtle, N. H. (1994), *Marketing Research in a Marketing Environment*, Irwin.

DNV Technica (1997), *Overview of Risks from BSE Via Environmental Pathways for the Environment Agency*, Det Norske Veritas Ltd., London, Report for the Environment Agency, Bristol.

Doney, P, M. and Cannon, J. P. (1997), "An examination of the nature of trust in buyer-seller relationships", *Journal of Marketing*, Vol. 61 No. 2, pp. 35-51.

Douthitt, R. (1995), "Consumer risk perception and recombinant bovine growth hormone: The case for labelling dairy products made from untreated herd milk". *Journal of Public Policy and Marketing,* Vol. 14 No 2, pp. 328-32.

Dowling, G. R. (1986), "Perceived risk: the concept and its measurement", *Psychology & Marketing*, Vol. 3, pp. 193-210.

Dowling, G. R. and Staelin, R. (1994), "A model of perceived risk and intended risk-handling activity", *Journal of Consumer Research*, Vol. 21 Issue 1, pp. 119-134.

Duggen, J. and Phillips C. (1998), "Listeria in the domestic environment", *Nutrition & Food Science,* Vol. 98 Issue 2.

Dulen, J. (1999), Dietary guidelines may address food safety, *Restaurants & Institutions*, Chicago, Vol. 109 Issue 12, pp. 108-109.

EC (1999a), "Abusive use and difficulties of controls of growth hormones increase risks", *Health and Consumer Protection Directorate-General, The* European Commission, 17 May.

EC (1999b), "Growth hormones in meat pose risk to consumers - different levels of evidence", *Health and Consumer Protection Directorate-General, The* European Commission, 17 May.

EC (2000), "Review of specific documents relating to the SCVPH opinion of 30 April 99 on the potential risks to human health from hormone residues in bovine meat and meat products", *Health and Consumer Protection Directorate-General, The* European Commission, 3 May.

Economist (1999), "Europe: Belgium's rotten food", *The Economist*, Vol. 351 Issue 8122, pp. 50-51.

Elangovan, A. R. (2001), "Causal ordering of stress, satisfaction and commitment, and intention to quit: a structural equations analysis", *Leadership and Organization Development*, Vol. 22 No. 4, pp. 159-165.

Eley, A. (ed.) (1992), *Microbial Food Poisoning*, Chapman & Hall, London.

Eley, A. (1997), "Escherichia coli 0157: an increasingly significant food-poisoning pathogen", *Nutrition & Food Science,* Vol. 97 Issue 3.

Ellen, P., Bone, P. and Stuart, E. (1998), "How well do young people follow the label? An investigation of four classes of over-the-counter drugs", *Journal of Public Policy & Marketing*, Ann Arbor, Spring, pp. 70-85.

EMS (2000a), "Agricultural use of antibiotics", *Environmental Media Services*, 2000.

EMS (2000b), "Public health concerns", *Environmental Media Services*, 2000.

Eom, Y. S. (1994), "Pesticide residue risk and food safety valuation: a random utility approach", *American Journal of Agricultural Economics,* St. Paul, Vol. 76 Issue 4, pp. 760-772.

Erevelles, S. (1993), "The Price - warranty contract and product attitudes", *Journal of Business Research*, Vol. 27, pp.171-181.

Euromonitor (2000), "Meat and poultry in the U K – meat and poultry", *Euromonitor: Global Market Information Database*, September.

European Commission Scientific Committee for Food (1997), *Opinion on Principles for the Development of Risk Assessment of Microbiological Hazards under the Hygiene of Foodstuffs Directive,* Brussels: European Commission, 93/43/EEC.

Facts (2001), "Salmonella - a food borne illness (symptoms and risks)", www.about-salmonella.com.

FAO (1998), *FAO/WHO Expert Consultation on the Application of Risk Communication to Food Standards and Safety Matters*, Rome, 2-6 February.

Field, A. (2000), *Discovering Statistics Using SPSS for Windows*, SAGE Publications, London.

Fielding, J. (1993), Coding and Managing Data in Gilbert, N. (ed.), *Researching Social Life*, Sage, London, pp. 218-238.

Fife-Schaw, C. and Rowe, G. (1996), "Public perceptions of everyday food hazards: psychometric study", *Risk Analysis*, Vol. 16 No. 4, pp. 487-500.

Fischhoff, B. (1989), Risk: A Guide to Controversy in National Research Council, *Improving Risk Communication*, National Research Council, Washington, DC, USA.

Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S. and Combs, B. (1978), "How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits", *Policy Sciences,* Vol. 9, pp. 127-152.

Fisher, I. S. T. (1999), "Salmonella enteritidis in Western Europe 1995-98 – a surveillance report from Enter-net", *Eurosurveillance*, Vol. 4, p.56.

Food facts (1999a), *Nutrition & Food Science,* Vol.9 Issue 2, 1999.

Food facts (1999b), *Nutrition & Food Science,* Vol.9 Issue 6, 1999.

Food for Future (1997), www.foodfuture.org.uk

Foodsense (1994a), *Food and Pesticides*, Ministry of Agriculture, Fisheries and Food.

Foodsense (1994b), *Food Facts not Fads*, Ministry of Agriculture, Fisheries and Food.

Foodsense (1996a), *Natural Toxicants in our Food*, Ministry of Agriculture, Fisheries and Food.

Foodsense (1996b), *Food Protection*, Ministry of Agriculture, Fisheries and Food.

Foodsense (1996c), *Food Emergencies*, Ministry of Agriculture, Fisheries and Food.

Foodsense (1996d), *About Food Additives*, Ministry of Agriculture, Fisheries and Food.

Foodsense (1996e), *Monitoring our food and nutrition*, Ministry of Agriculture, Fisheries and Food.

Ford, N. and Murphy, G. (1998), "Managing environmental risks from genetically modified organisms: the role of safety training", *Environmental Management and Health,* Vol.9 Issue 3.

Fowler, F. J. (1988), *Survey Research Methods*, Newbury Park, CA: Sage.

Fornell, C. and Larcker, D. (1981), "Evaluating structural equation models and unobservable variables and measurement error", *Journal of Marketing Research*, Vol. 18, February, pp. 39-50.

Frewer, L., Howard, C. and Shepherd, R. (1995a), "Consumer perceptions of food risks", *Food Science and technology,* Vol. 9 No. 4, pp 212-216.

Frewer, L., Howard, C. and Shepherd, R. (1995b), "Genetic engineering and food: What determines consumer acceptance?", *British Food Journal,* Vol. 97 No. 8, pp. 31-36.

Frewer, L. J., Howard, C. and Shepherd, R. (1997), "Public concerns in the United Kingdom about general and specific applications of genetic engineering: risk, benefit, and ethics", *Science, Technology & Human Values*, Vol. 22 No. 1, pp. 98-124.

Frewer, L., Howard, C. and Shepherd, R. (1998), "Understanding public attitudes to technology", *Journal of Risk Research,* Vol. 1 Issue 3, pp. 221-235.

Frewer, L. J., Howard, C., Hedderley, D. and Shepherd, R. (1996), "What determines Trust in Information about Food-Related Risks? Underlying Psychological Constructs", *Risks Analysis,* Vol. 16 No. 4, pp. 473-486.

Frewer, L. J., Howard, C., Hedderley, D. and Shepherd, R. (1997), "Consumer Attitudes towards different Food-Processing Technologies used in Cheese Production – The influence of consumer benefit", *Food Quality and Preference*, Vol.8 No. 4, pp. 271-280.

Frewer, L. J., Howard, C., Hedderley, D. and Shepherd, R. (1998), "Methodological approaches to assessing Risk Perceptions associated with Food-Related Hazards", *Risk Analysis*, Vol. 18 No. 1, pp. 95-102.

Frewer, L. J. and Shepherd, R. (1995), "Ethical concerns and Risk Perception associated with different applications of Genetic Engineering: Interrelationships with the Perceived Need for Regulation of the Technology", *Agriculture and Human Values,* Vol. 12 No.1, pp. 48-57.

Frewer, L., Shepherd, R. and Sparks, P. (1994a), "Biotechnology and food production: knowledge and perceived risk", *British Food Journal,* Vol. 96 No. 9, pp. 26-32.

Frewer, L. J., Shepherd, R. and Sparks, P. (1994b), "The role of perceived knowledge and perceived control in risk perceptions associated with a range of food-related hazards", *Food Safety,* Vol. 14, pp. 19-40.

Frost, K., Frank, E. and Maibach, E. (1997), "Relative risk in the news media: a quantification of misrepresentation", *American Journal of Public Health*, Washington, Vol. 87 No. 5, pp. 842-845.

FSA (1999), "Dioxin contamination of Belgian animal products - a background note", *Food Standard Agency,* August 10.

FSA (2000a), "Food Standards Agency BSE controls review", *News,* Food Standards Agency, No. 2, November.

FSA (2000b), "Foodborne disease: developing a strategy to deliver the agency's targets", Food Safety Agency Paper 00/05/02.

FSA (2000c), "Most pesticide levels within safety limits", *Food Standards Agency News*, No. 1, October.

FSA (2001a), "Sounding out consumers on food standards", *Food Standards Agency News,* No. 6, March.

FSA (2001b), "*Salmonella* in retail chicken drops to all time low but the battle with *Campylobacter* continues", *Food Standards Agency*, Press Releases, 16 August.

FSAC (1993), *Food Safety - Questions and Answers*, Second Edition, Food Safety Advisory Centre, 1993.

Gofton, L. (1986), The Rules of the Table: Sociological Factors Influencing Food Choice, in Ritson, C., Gofton, L. and McKenzie, J. (eds.), *The Food Consumer*, John Wiley & Sons, Chichester, pp. 127-153.

Goodwin, P. and Wright, G. (1997), *Decision Analysis for Management Judgement*, Wiley, London.

Gottlieb, S. (2000), “Drug resistant bacteria cause fresh concerns”, *British Medical Journal*, Vol. 320, pp. 1228.

Green, E. (1996), “Blair should listen to the screamers”, *New Statesman*, Vol. 127 Issue 4415, p27.

Gregoriadis, L. (1999), “GM foods overtake BSE as top safety concern, says survey”, *The Guardian,* 4 September, 1999

Grobe, D. and Douthitt, R. (1995), "Consumer acceptance of recombinant bovine growth hormone: Interplay between beliefs and perceived risks”, *The Journal of consumer Affairs,* Vol. 29 No 1, pp. 128-138.

Guardian (1999a), “Countdown to the food crisis”, *The Guardian*, 15 February, 1999.

Guardian, (1999b). “Battle fields”, *The Guardian*.14 September, 1999.

Hair, J. F. Jr., Anderson, R. E., Tatham, R. L. and Black, W. C. (1992), *Multivariate Data Analysis*, MacMillan, N. Y.

Hargreaves, D. (1999), “GM foods: unease prompts rethink”, *Financial Times*, UL, May.31.

Harris, L. (1990), Science at the supermarket, in National Consumer Council (ed.), *Your Food, Whose Choice*? HMSO, London, pp. 183-184.

Hart, D. (1997), “Can agency pull off the confidence trick?” *The Grocer*, Vol. 220 No.7313, p. 59.

Heaney, J. and Goldsmith, R. (1999), “External information search for banking services”, *The International Journal of Bank Marketing*, Vol. 17 No. 7, pp. 305-323.

Hellesoy, O., Gronhaug, K. and Kvitasteinargue, O. (1998), “Profiling the high hazards perceivers: an exploratory study”, *Risk Analysis*, Vol. 18 No.3, pp. 253-259.

Henkel, J. (1998), “Irradiation: a safe measure for safer food”, *U. S. Food and Drug Administration*, June.

Henson, S. and Northen, J. (2000), “Consumer assessment of the safety of beef at the point of purchase: a Pan-European study”, *Journal of Agricultural Economics,* Vol. 51, No. 1, pp. 90-105.

Hingley, A. (1999), "Campylobacter: low-profile bug is food poisoning leader", *U S Food and Drug Administration*, September-October, 1999.

HMSO (1995), *A guide to Risk Assessment and Risk Management for Environmental Protection, Department of the Environment*, HMSO, pp.77-78.

Horby, P., Rushby, A., Graham, C. and O'Mahony, M. (1999), "PHLS: overview of communicable disease, Part I", Public Health Laboratory Service.

Hoover, R. J., Green, R. T. and Saegert, J. (1978), "A cross-national study of perceived risk", *Journal of Marketing,* Vol. 42, No. 8, pp. 26-38.

Horton, R. L. (1976), "The structure of decision risk: some further progress", *Journal of Academy of Marketing Science,* Vol. 42, No. 3, pp. 102-108.

Hoyle, R. H. (1995), Structural Equation Modelling – Concepts, Issues and Applications, SAGE Publications.

Hughes, M. (1996), Interviewing in Greenfield, T. (ed.), *Research Methods – Guidance for Postgraduates*, Arnold, London.

Huang, C. L. (1993), "Simultaneous-equation model for estimating consumer risk perceptions, attitudes, and willingness-to-pay for residue-free produce", *The Journal of Consumer Affairs*, Madison, Vol. 27 Issue 2, pp.377-388.

Hugstad P., Taylor J. W. and Bruce G. D. (1987), "The effects of social class and perceived risk on consumer information search", *The Journal of Services Marketing*, Vol. 1 No. 1, pp.47-53.

Hume, S. (2001), "Mad-cow mania shows frailty of diner confidence", *Restaurants & Institutions*, Chicago, Vol. 111 Issue 2, pp. 68-69.

Iacobucci, D. (1994), Classic factor analysis in Bagozzi, R. P. (Ed.), *Principles of Marketing Research,* Blackwell Business.

IAH (2000), "Reducing the risks of *Salmonella* food poisoning", *Institute for Animal Health.*

IASTATE (2001), "Food safety: lesson one", www.extension.iastate.edu

IFIC (1995), "IFIC Review: On pesticides and food safety", IFIC January 1995.

IFRDM (1996), "Oldies know best of food safety", *International Journal of Retail & Distribution Management*, Vol. 24 No. 11, News and Reports, pp. i-ii.

IFST (1995a), "Foodborne *Campylobacteriosis* – and how to safeguard against it", *Institute of Food Science & Technology,* position paper, September.

IFST (1995b), "*Listeria monocytogenes* in cheese", *The Institute of Food Science & Technology*, position paper, September.

IFST (1996), "Verocytotoxin-producing *E.Coli* food poisoning and its prevention", *The Institute of Food Science & Technology*, position paper, September.

IFST (1997), "Salmonella typhimurium DT 104", *Institute of Food Science & Technology,* position paper, September.

IFST (1998), "Microbiological food safety for children and vulnerable groups", *The Institute of Food Science & Technology*, position paper, October.

IFST (1999a), "The use of irradiation for food quality and safety", *Institute of Food Science & Technology,* position statement, December.

IFST (1999b), "Genetic modification and food", *The Institute of Food Science & Technology*, position paper, September.

Jacobs, P. (1999), "Protest may mow down trend to alter crops; biotech: public outcry over genetically modified foods has the U S agricultural industry backpedaling". *The Los Angeles Times*, Los Angeles, Calif. 5 October, 1999.

Jacoby, J. and Kyner, D. B. (1973), "Brand loyalty vs. repeat purchasing behaviour", *Journal of Marketing Research*, Vol. 10, February, pp. 1-9.

James, P. (1997), "Food Standards Agency (FSA): report by Professor Philip James", www.riphh.org.uk/hot.topic04.html.

Jardine, A. (1999), "GM scare strains retailers - genetically modified foods", *Marketing,* 18 February 1999, p. 7.

Jarvis, L. (2001), "Antibiotic feed additives under review by FDA", *Chemical Market Report*, New York, January 22.

Johnston, A. M. (2000), "Animal health and food safety", *British Medical Bulletin,* Vol. 56 No. 1, pp. 51-61.

Jones, L. (1996), "Food biotechnology: current developments and the need for awareness", *Nutrition & Food Science*, Vol. 96 Issue 6, 1996.

Joreskog, K. G. and Sorbom, D. (1998), *LISREL 8: User's Reference Guide,* Scientific Software International.

Joreskog, K. G. and Sorbom, D. (1999), *PRELIS 2: User's Reference Guide,* Scientific Software International.

Jungermann, H. Schutz, H. and Thuring, M. (1988), "Mental models in risk assessment: informing people about drugs", *Risk Analysis*, Vol. 8 No. 1, pp. 147-155.

Kaplan, L. B., Szybillo, G. J. and Jacoby, J. (1974), "Components of perceived risk in product purchase: a cross-validation", *Journal of Applied Psychology,* Vol.59 No.3, pp. 287-291.

Kasper, R. G. (1980), Perceptions of Risk and Their Effects on Decision Making, in Schwing, R. C and Albers, Jr. W. A. (eds.) *Societal Risk Assessment – How Safe is Safe Enough?* Plenum Press, New York.

Kasperson, R. E., Renn, O., Slovic, P., Brown, H. S., Emel, J., Goble, R., Kasperson, J. X. and Raticks, S. (1988), "The social amplification of risk: a conceptual framework", *Risk Analysis*, Vol. 8, pp.177-187.

Kelloway, E. K. (1998), *Using LISREL for structural equation modelling*, Sage Publication.

Kerlinger, F. N. (1986), *Foundation of Behavioural Research,* HRW Int'l Ed.

Khachatourians, G. G. (1998), "Agricultural use of antibiotics and the evolution and transfer of antibiotic-resistant bacteria", *Canadian Medical Association Journal*, Vol. 159 No. 9, pp. 1129-1136.

Kipps, M., Eves, A., Noble, C. and Noble, A. (1994), "Nutrition and Health issues: Expert opinion – in Harmony or Disagreement?", *Nutrition & Food Science,* Vol. 94 Issue 4.

Kogan, N. and Wallach, M. A. (1964), *Risk Taking, a study in Cognition and Personality,* Holt, Rienhart and Winston, New York.

Kuznesof, S., Tregear, A. and Moxey, A. (1997), "Regional foods: a consumer perspective", *British Food Journal*, Vol. 99 No.6, pp. 199-206.

Lanzetta, J. T. and Driscoll, J. M. (1968), "Effects of uncertainty and importance on information search in decision making", *Journal of Personality and Social Psychology,* Vol. 10 No. 4, pp. 479-486.

Laroche, M., Kim, C. and Tomiuk, M. (1999), "Italian ethnic identity and its relative impact on the consumption of convenience and traditional foods", *British Food Journal*, Vol. 101 No. 3, pp. 201-228.

Latouche, K., Rainelli, P. and Vermersch, D. (1998), "Food safety issues and the BSE scare: some lessons from the French case", *Food Policy,* Vol. 23 No.5, pp. 347-356.

Lave, L. B. (1980), Economic Tools for Risk Reduction, in Schwing, R. C and Albers, Jr. W. A. (eds.) *Societal Risk Assessment – How Safe is Safe Enough?* Plenum Press, New York.

Lave, L. B. and Menkes, J. (1985), "Managing risk: a join U.S. – German perspective", *Risk Analysis*, Vol. 5 No. 1, pp. 17-23.

Leininger, M. (1994), Evaluation Criteria and Critique of Qualitative Research Studies in Morse, J. (Ed.), *Critical Issues in Qualitative Research Methods*, Sage.

Lichtenberg, J. and MacLean, D. (1991), The Role of Media in Risk Communication, in Kasperson, R. E. and Stallen, P. M. (eds.) *Communicating Risks to the Public: International Perspectives*, Kluwer Academic Publishers, Netherlands.

Lindheim, J. (1989), "Distress signals", *Management Today*, London, April, pp. 101-3.

Lindsay, L. (2000), "Credible food safety assurance for the whole meat chain", *Nutritiion & Food Science*, Vol. 30 No. 5, pp. 250-252.

Lo, H. P. (1998), "Research design and primary data collection", *Unpublished paper*.

Lofstedt, R. E. and Frewer, L. (1998) (eds.), *The Earthscan Reader in Risk and Modern Society*, Earthscan Publications Ltd., London.

Lofstedt, R.E. and Renn, O. (1997), "The Brent Spar controversy: an example of risk communication gone wrong", *Risk Analysis*, Vol. 17 No. 2, pp. 131-136.

Lynch, Jr. J., Marmorstein, H. and Weigold, M. (1988), "Choices from sets including remembered brands: use of recalled attributes and prior overall evaluations", *Journal of Consumer Research*, Vol. 15, September, pp. 169-184.

Lynn, P. (1996), Principles of Sampling in Greenfield, T. (ed.), *Research Methods – Guidance for Postgraduates*, Arnold, London.

MacCallum, R. C., Browne, M. W. and Sugawara, H. M. (1996), "Power analysis and determination of sample size for covariance structure modelling", *Psychological Methods*, Vol. 1 No. 2, pp. 130-149.

MAFF (2000), *The BSE Inquiry Report: The Inquiry into BSE and variant CJD in the United Kingdom (The Phillips Report)*, Ministry of Agriculture, Fisheries and Food, London.

MAFF Statistics (2000a), "Household food consumption, expenditure and nutrient intake", *Government Statistical Service,* March.

MAFF Statistics (2000b), "Poultry and poultrymeat statistics notice", *Government Statistical Service,* March.

Magnusson, M. Arvola, A., Hursti, U., Aberg, L. and Sjoden, P. (2001), "Attitudes towards organic foods among Swedish consumers", *British Food Journal*, Vol. 103 No. 3, pp. 209-226.

Mainland, D. D. (1998), “Health and the demand for food in Scotland: economic and demographic effects”, *British Food Journal,* Vol. 100, No. 6, pp. 273-77.

Maney, A. and Plutzer, E. (1996), “Scientific information, elite attitudes and the public debate over food safety”, *Policy Studies Journal,* Vol. 24, pp.42-56.

Marconlides, G. A. and Hershberger, S. L. (1997), *Multivariate Statistical Methods – A first course*, Lawrence Erlbanm Associated Publishers.

Marongiu, S. and Ekehammar, B. (1999), “Internal and external influences on women's and men's entry into management”, *Journal of Managerial Psychology*, Volume 14 No. 5;

Marris, C. and Langford, I. (1996), “No cause for alarm”, *New Scientist*, Vol. 151, pp. 36-39.

Marshall, C. and Rossman, G. (1999), *Designing Qualitative Research*, Newbury Park, Sage.

Marshall, S. (1994), “Genetically Modified Organisms and Food”, *Nutrition & Food Sciaence,* Vol.96 Issue 6, 1996.

Martin, M. (1997), “A taste of the future”, *Good Housekeeping Food Seminar*, Campaign, September 5, 1997, pp. 26-27.

Maruyama G. M. (1997), *Basic Structural Equation Modelling*, Sage Publication.

McDaniel, C. Jr. and Gates, R. (1993), *Contemporary Market Research,* West Publishing Company, New York, N.Y.

McIlveen, H., Abraham, C. and Armstrong, G. (1999), “Meat avoidance and the role of replacers”, *Nutrition & Food Science*, Vol. 99 Issue 1.

McKellar, Q. (1999), “Antibiotics and resistance in farm animals”, *Nutrition & Food Science,* Vol. 99 Issue 4.

Meikle, J. (1999a), “Up to one in five chickens or turkeys contaminated”, *The Guardian,* 8 February.

Meikle, J. (1999b), ”Organic food sales booming”, *The Guardian*, 7 September.

Meikle, J. (2000), “Having chicken for Sunday lunch”, *The Guardian,* 29 January.

Meikle, J. and Brown, P. (1999), “Alarms rang 50 years ago”, *The Guardian,* 7 September.

Menguc, B. (1996), “Evidence for Turkish industrial salespeople: testing the applicability of a conceptual model for the effect of effort on sales performance and job satisfaction”, *European Journal of Marketing*, Vol. 30 No. 1 pp. 33-51.

Miles, M. and Huberman, A. (1994), *Qualitative Data Analysis: A Sourcebook of New Methods*, Sage.

Miles, S. (1999a), “The food industry”, *The Institute of Agricultural Management: National Farm Management Conference,* November.

Miles, S. (1999b), “Characterising Specific Food Issues Questionnaire”, *Personal Communication*

Miles, S. and Frewer, L. (1999), “Effective risk communication about food-related hazards: a review of the literature”, *Ministry of Agriculture, Fisheries and Food project number FS1844.*

Miles, S., Braxton, D. and Frewer, L. (1999), “Public perceptions about microbiological hazards in food”, *British Food Journal,* Vol. 101 No 10, pp. 744-762.

Miller, H. and Huttner, S. (1995), “Food produced with new biotechnology: can labeling be anti-consumer?” *Journal of Public Policy & Marketing,* Vol.14 Issue 2, pp.330-334.

Mintel (1997), “Food safety”, *Mintel*, August.

Mitchell, V. W. (1994), “How to Identify Psychographic Segments”, *Marketing Intelligence and Planning,* Vol. 12 No.7, pp. 4-10.

Mitchell, V. W. (1998a), “A role for consumer risk perceptions in grocery retailing”, *British Food Journal,* Vol. 100 No.4, pp. 171-183.

Mitchell, V. W. (1998b), “Defining and measuring perceived risk”, *The academy of Marketing Annual Conference,* 1998, pp.380-384.

Mitchell, V. W. (1999), “Consumer perceived risk: conceptualisations and models”, *European Journal of Marketing,* Vol. 33, Issue 1/2, pp. 163-95.

Mitchell, V. W. and Boustani, P. (1992), “Consumer Risk Perception in the Breakfast Cereal Market”, *British Food Journal,* Vol. 94 Issue 4, pp.17-26.

Mitchell, V. W. and Boustani, P. (1994), “A preliminary investigation into pre- and post-purchase risk”, *European Journal of Marketing*, Bradford, Vol. 28 Issue 1, pp. 56-71.

Mitchell, V.W. and Greatorex, M. (1988), “Consumer risk perception in the U K wine market”, *European Journal of Marketing,* Vol. 22 Issue 9, pp.5-15.

Mitchell, V. W. and Greatorex, M. (1989), "Risk reducing strategies used in the purchase of wine in the UK", *European Journal of Marketing,* Vol.23 Issue 9, pp.31-47.

Mitchell, V. W. and Greatorex, M. (1990), "Perceived risk and risk reducing strategies across product classification", *Proceedings of 23rd MEG Conference,* Vol. 2, June, Oxford, pp. 940-955.

Mitchell, V. W. and Vassos, V. (1997), "Perceived risk and risk reduction in holiday purchases: a cross-cultural and gender analysis", *Journal of Euro – Marketing*, New York, Vol. 6 Issue 3, pp. Pp. 47-79.

Mitra, K., Reiss, M. C. and Capella, L. M. (1999), "An examination of perceived risk, information search and behavioral intentions in search, experience and credence services", *The Journal of Services Marketing*, Vol. 13 Issue 3, pp. 208-228.

MLC (2001), *Meat Demand Trends*, Meat and Livestock Commission, issue no. 01/1, March.

Monroe, K. B. (1973), "Buyers' subjective perception of price", *Journal of Marketing Research*, Vol. 10, February, pp. 70-80.

Morgan, R. M. and Hunt, S. D. (1994), "The commitment-trust theory of relationship marketing", *Journal of Marketing*, Vol.58, pp. 20-38.

Muhlenberg, W. (1992), "Chicken feed contaminated with *Salmonella enteritidis* in a small egg-producing farm as source of a chain of infection in man – probes in tracing the mode of transmission", Gesundheitswesen, Vol. 54 No. 3, pp. 127-134.

Nagy, B. and Mulder, R. (2000), "Pathogenic micro-organisms in poultry and eggs", *Cordis RTD-Projects/European Communities.*

National Research Council (1989), *Committee on Risk Perception and Communication - Improving Risk Communication,* National Academy Press, Washington, D C.

Newman, J. and Werbel, R. (1973), "Multivariate analysis of brand loyalty for major household appliances", *Journal of Marketing Research*, Vol. X, November, pp. 404-409.

Newton, D. A. (1967), A Marketing Communication Model for Sales Management, in Cox D. F. (ed.), *Risk Taking & Information Handling in Consumer Behaviour,* Graduate School of Business Administration, Harvard University, Boston.

NFU (1998), *Animal Welfare*, National Farmers' Union, Information leaflet.

NFU (2000a), *Food safety,* National Farmers' Union, www.nfu.org.uk

NFU (2000b), *Genetically Modified Organisms (GMOs)*, National Farmers' Union, Information leaflet

Nielson, C. (1996), "An empirical examination of switching cost investments in business-to-business marketing relationships", *The Journal of Business and Industrial Marketing,* Vol. 11 No. 6, pp. 38-60.

Nielson, C. (1998), "An empirical examination of the role of closeness in industrial buyer-seller relationships", *European Journal of Marketing,* Vol. 32, No. 5/6, pp. 441-463.

Oosterom, J. (1991), "Epidemiological studies and proposed preventive measures in the fight against human *Salmonellosis*", *International Journal of Food Microbiology,* Vol. 12 No. 1, pp. 41-51.

Palmer, C. M. (1996), "A week that shook the meat industry: the effects on the UK beef industry of the BSE crisis", *British Food Journal*, Vol. 98 No. 11, pp. 17-25.

Palmer, T. (1998), "Standard bearer - The Canadian Food Inspection Agency", *The Grocer*, Vol. 221 No. 7349, p. 36.

Pang, N (1996), "School values and teachers' feelings: a LISREL model", *Journal of Educational Administration*, Volume 34 No. 2.

Peter, J. P. (1979), "Reliability: a review of psychometric basics and recent marketing practices", *Journal of Marketing Research*, Vol. 17 No. 1, pp. 6-17.

Philips, C. and Roscoe, N. (1996), "Survival of Escherichia coli 0157: H7 in ground beef during normal cooking procedures", *Nutrition & Food Science,* Vol. 96 Issue 2.

Phillips, C. (1995), "Incidence of Campylobacter and possible modes of transmission", *Nutrition and Food Science,* Vol. 95 Issue 1.

PHLS (1998), "Pathogenic micro-organisms in poultry and eggs", *Public Health Laboratory Services,* London.

Pidgeon, N., Hood, C., Jones, D., Turner, B. and Gibson, R. (1992), Risk Perception in Royal Society, *Risk Analysis, Perception and Management*, The Royal Society.

Pigott, R. and Kirby, A. (1999), "Q&A: How safe if our meat?" *BBC*, 29 October.

Pollack, A. (1999), "A disputed study suggests possible harm from genetically altered food", *New York Times,* New York, 15 October.

Potter, J. (1998), "Misperceptions of risk", *Journal of Communication*, New York, Vol. 48 No. 4, pp. 162-167.

Powell, D. (1998), "Setting the stage: understanding communication issues with foodborne pathogens", *Candian Cattlemen: Quality Starts Here Workshop on Foodborne Pathogens*, 4 May, www.oac.uoguelph.ca

Pretty, J. (1998), *The Living Land - Agriculture, Food and Community Regeneration in Rural Europe*, Earthscan Publications Ltd., London.

Pring, A. (1997), "FSA steps into a nanny state?" *The Grocer*, Vol.220 No. 7322, pp. 34-36.

Pugh, R. (1990), "Food safety and the retail industry", *International Journal of Retail and Distribution Management,* Vol. 18 No. 6, pp. 3-7.

Raats, M. and Shepherd, R. (1996), "Developing a subject-derived terminology to describe perceptions of chemicals in foods", *Risk Analysis*, Vol. 16 No 2, pp. 133-146.

Raeburn, P. (2001), "Agribusiness", *Business Week,* January 8, 2001.

Rayner, S. and Cantor, R. (1987), "How fair is safe enough? The cultural approach to societal technology choice", *Risk Analysis*, Vol. 7 No. 1, pp.3-9.

Renn, O., Webler, T. and Kastenholz, H. (1996), "The Brent Spar Controversy: an example of risk communication gone wrong", *Risk Analysis*, Vol. 17 No. 2, pp. 131-136.

Roehl, W. S. and Fesenmaier, D. R. (1992), "Risk Perception and Pleasure Travel: An exploratory analysis", *Journal of Travel Research,* Vol. 30 Issue 4, pp.17-29.

Roselius, T. (1971), "Consumer rankings of risk reduction methods", *Journal of Marketing,* Vol. 35 No.1, pp. 56-61.

Rossiter J. R. and Percy, L. (1987), *Advertising & Promotion Management*, McGraw Hill International Edition, New York.

Royal Society (1992), *Risk: Analysis, Perception and Management*, The Royal Society, London.

Rozin, P., Pelchat, M. L. and Fallon, A. E. (1986), Psychological Factors influencing Food Choice, in Ritson, C., Gofton, L. and Mckenzie, J. (eds.), *The Food Consumer*, John Wiley & Sons Ltd., pp. 85-106.

Rundmo, T. and Sjoberg, L. (1998), "Risk perception by offshore oil personnel during bad weather conditions", *Risk Analysis*, Vol. 18 No.1, pp. 111-118.

Saba, A., Moles, A. and Frewer, L. J. (1998), "Public concern about general and specific applications of genetic engineering: a comparative study between the U K and Italy", *Nutrition & Food Science*, Vol. 98 Issue 1.

Sanders, T.A.B. (1999), "Food production and food safety", *British Medical Journal*, Vol. 318 No. 7199, pp. 1689-1693.

Sandman, P. M. (1987), "Risk communication: Facing public outrage", *EPA Journal,* Vol. 13, pp. 21-22.

Sandman, P. M. (1993), "Communicating Risk: Some Basics", *Health & Environment Digest*, Vol. 1, pp. 3-4.

Schumacker, R. E. and Lomax, R. G. (1996), *A beginner's guide to Structural Equation Modeling*, Lawrence Erlbaum Associates, Publishers, New Jersey.

Sethi, V. and King, W. R. (1994), "Development of measures to assess the extent to which an information technology application provides competitive advantage", *Management Science,* Vol. 40, No. 12, pp. 1601-1627.

Selnes, F. (1998), "Antecedents and consequences of trust and satisfaction in buyer-seller relationships", *European Journal of Marketing,* Vol. 32, No. 3/4, pp. 305-22.

Shapiro, B. P. (1973), "Price reliance: existence and sources", *Journal of Marketing Research*, Vol. 10, August, pp.286-294.

Sheppard, J. (1996), "Viewpoint: spilling the genes - what we should know about genetically engineered foods", *British food Journal,* Vol. 98 No 10, pp 3-4.

Sheth, J. N. and Venkatesan, M, (1968), "Risk Reduction Processes in Repetitive Consumer Behavior", *Journal of Marketing Research*, Vol. 5, pp. 307-310.

Shrader-Frechette, K. (1990), "Scientific Method, Anti-Foundationalism and Public Decision Making", *Risk: Health Safety and Environment*, Vol. 1 No. 1, pp. 23-41.

Silver, D. (2001), "Consumer confidence in food safety takes a hit", *Restaurants & Institutions*, January 1, 2001.

Slovic, P. (1986), "Informing and educating the public about risk", *Risk Analysis*, Vol. 6 No. 4, pp. 403-415.

Slovic, P. (1987), "Perception of risk", *Science*, Vol. 236, pp. 280-285.

Slovic, P. (1998), "Perceived risk, trust and democracy", in Lofstedt, R and Frewer, L (Eds.), *Risk and Modern Society,* Earthscan, London.

Slovic, P. and Lichtenstein, S. (1968), "Relative importance of probabilities and payoff in risk taking", *Journal of Experimental Psychology Monograph,* Vol. 78.

Slovic, P., Fischhoff, B. and Lichtenstein, S. (1980), Facts and fears: understanding perceived risks, in Schwing, R. and Albers, W. Jr. (eds.) *Societal Risk Assessment: How safe is safe enough?* Plenum, New York, pp.181-216.

Slovic, P. (2002), Personal communication with the researcher.

Smith, J. L. (2001), "Produce as a vector for *Campylobacteriosis*", *Microbial Food Safety Research Unit*, www.arserrc.gov.

Smith, D. and Riethmuller, P. (1999), "Consumer concerns about food safety in Australia and Japan", *International Journal of Social Economics*, Vol. 26 No. 6, pp. 724-741.

Sofres (2001), *Consumer Attitudes to Food Standards*, Report for COI Communications and Food Standard Agency, Taylor Nelson Sofres plc, London, UK.

Sparks, P. and Shepherd, R. (1994a), "Public perceptions of the potential hazard associated with food production and food consumption: an empirical study", *Risk Analysis*, Vol.14 No.5, pp. 799-806.

Sparks, P. and Shepherd, R. (1994b), "Public perceptions of food-related hazards: individual and social dimensions", *Food Quality and Preference,* Vol. 5, pp185-194.

Stark K. D. (2000), "Food safety achieved through herd management", *Schweizer Archiv fur Tierheilkunde,* Vol. 142 No. 12, pp. 673-8.

Starr, C. (1969), "Social benefit versus technological risk", *Science*, Vol. 165, pp. 1232-1238.

Starr, C. (1985), "Risk management, assessment and acceptability", *Risk Analysis*, Vol. 5, pp. 97-102.

Stern, R. M. (1985), "The management of risk: application to the welding industry", *Risk analysis*, Vol. 5 No. 1, pp. 63-73.

Stone, E. F. (1978), *Research Methods in Organisational Behaviour*, Goodyear, pp. 115-138.

Stone, R. and Gronhaug, K. (1993), "Perceived risk: further considerations for the marketing discipline", *European Journal of Marketing*, Vol. 27 No.3, pp. 39-50.

Suzuki, S. (1994), "Pathogenicity of Salmonella enteritidis in poultry", *International Journal of Food Microbiology*, Vol. 21 No. 1-2, pp. 89-105.

Tabachnick, B. G. and Fidell, L. S. (1996), *Using Multivariate Statistics*, Third edition, Harper & Row, Publishers, Inc., New York, pp. 575 - 633.

Taylor, J. (1974), "The role of risk in consumer behaviour", *Journal of Marketing,* Vol. 38, pp. 54-60.

Taylor, S. (1994), "Waiting for service: the relationship between delays and evaluations of service" *Journal of Marketing,* Vol. 58, pp. 56-69.

Taylor, S. A., Steer, T. E. and Gibson, G. R.(1999), "Diet, bacteria and colonic cancer", *Nutrition and Food Science*, Vol. 99 Issue 4.

Teague, J. L. and Anderson, D. W. (1995), "Consumer preferences for safe handling labels on meat and poultry", *The Journal of Consumer Affairs*, Madison, Vol. 29 Issue 1, pp. 108-119.

Tesch, R (1990), *Qualitative research: analysis types and software tools*. New York; Falmer.

Thompson, S. (1999), "Brands wage battle against bacteria", *Brandweek*, New York, Vol. 40 Issue 14, pp. 52-53.

Thorelli, H. B., Lim, J. and Ye, J. (1989), "Relative importance of country of origin, warranty, and retail store image on product evaluations", *International Marketing Review*, Vol. 6 No. 1.

Tietjen, M. and Fung, D. Y. (1995), "Salmonella and food safety", *Critical Reviews in Microbiology,* Vol. 21 No.1, pp. 53-83.

TNS (2001), *Consumer Attitudes to Food Standards*, Report for COI Communications and Food Standard Agency, Taylor Nelson Sofres plc., London, UK.

Todar. K. (1996), "Bacterial resistance to antibiotics, *CALS Pathogen/Pest Resistance Discussions*, University of Wisconsin, Department of Bacteriology.

Tracey, M. and Tan, C. (2001), "Empirical analysis of supplier selection and involvement, customer satisfaction, and firm performance", *Supply Chain Management: An International Journal*, Vol. 6 No. 4, pp. 174-188.

Travis, A. (1999), Scientists take flak over food scares, *The Guardian*, 8 June.

Tregear, A., Dent, J. and McGregor, M. (1994), "The demand for organically grown produce", *British Food Journal*, Vol. 96 No. 4, pp. 21-25.

Trickett, J. (1997), *Food Hygiene for Food Handlers*, Second Edition, Macmillan Press Ltd.

Tse, A. C. B. (1999), "Factors affecting consumer perceptions on product safety", *European Journal of Marketing*, Vol. 33 No. 9/10, pp.911-925.

Van Vianen, A. (1999), "Managerial self-efficacy, outcome expectancies, and work-role salience as determinants of ambition for a managerial position", *Journal of Applied Social Psychology*, Vol. 29 Issue 3, pp. 639.

Viscusi, W. K. (1991), "Toward a proper role for hazard warnings in products liability cases", *Journal of Products and Toxics Liability*, New York, pp. 139-164.

Viscusi, W. K. and Evans, W. (1998), "Estimation of revealed probabilities and utility functions for product safety", *The Review of Economics and Statistics,* Cambridge Vol. 80 Issue, pp. 28-33.

Walkley, S. (1999), "Cutting through the red tape in Europe", *Frozen Food Age,* New York.

Wandel, M. (1994), "Understanding consumer concern about food-related health risks", *British Food Journal,* Vol. 96 No. 7, pp. 35-40.

Watson, R. (2000a), "European Commission proposes a European food authority", *British Medical Journal*, Vol. 320 No. 7229, p. 208.

Watson, R. (2000b), "EU plans new food authority", *British Medical Journal*, Vol. 321 No. 7271, p. 1245.

Weber, E. and Milliman, R. (1997), "Perceived risk attitudes: relating risk perception to risk choice", *Management Science*, Vol. 43 Issue 2, pp. 123-144.

Weiss, R. (1999), "Gene-altered food study fuels a fire", *The Washington Post,* Washington, 15 October.

Wenzel, R. P. and Edmond, M. B. (2000), "Managing antibiotic resistance", *The New England Journal of Medicine,* Vol. 343 No. 26, pp. 1961-3.

Which? (1996), "Food Poisoning – *Campylobacter* and *Salmonella*", www.Which.net.

Which? (2001a), "Tesco is best in contaminated chicken tests", www.Which.net.

Which? (2001b), "*Campylobacter* and *Salmonella*", www.Which.net.

Whitney, C. G., Farley, M. M., Hadler, J., Harrison, L. H., Lexau, C., Reingold, A., Lefkowitz, L., Cieslak, P. R., Cetron, M., Zell, E. R., Jorgensen, J. H., Schuchat, A., Facklam, R. R. and Bennett, N. M. (2000), "Increasing prevalence of multidrug-resistant Streptococcus pneumoniae in the United States", *The New England Journal of Medicine,* Vol. 343 No. 26, pp. 1917-24.

Whitworth, M. and Simpson, G. (1997), "Agro culture - integration of farming and food retailing", *The Grocer,* Vol. 219 No. 7312, pp.30-32.

WHO (1996), "Emerging foodborne diseases", *World Health Organisation*, Fact sheet No. 124, (Revised) November.

Wilkes, M. (1989), *Operations Research: Analysis and Applications,* McGraw-Hill, London.

Wohl, J. (1998), “Consumer’ decision-making and risk perceptions regarding foods produced with biotechnology”, *Journal of Consumer Policy,* Vol. 21 No. 4, pp. 387-404.

Worsfold, D. (1995), “Recipe for food safety”, *Nutrition & Food Science*, Vol. 95 No. 6, pp. 22-25.

Yavas, U. (1992), “Out-of-Country travel patterns in an Arabian Gulf Country”, *Journal of International Marketing and Marketing Research*, Vol.17 Issue1, pp. 9-18.

Yavas, U., Riecken, G. and Babakus, E. (1993), “Efficacy of perceived risk as a correlate of reported donation behaviour: An empirical analysis”, *Academy of Marketing Science Journal,* Vol. 21 Issue 1, pp.65-70.

Yavas, U., Verhage, B. and Green, R. (1992), “Global consumer segmentation versus local market orientation”, *Management International Review*, Wiesbaden, Vol. 32 Issue 3, pp. 265-272.

Yee, W. M. S. (2001a), “Food safety: antecedents and consequence of trust in livestock farmers”, *Second Postgraduate Research Conference, Cranfield University*, June.

Yee, W. M. S. (2001b), “Sharing of customer data in electronic marketplace: trust in interfirm partnerships”, *Americas Conference on Information Systems, August*.

Yee, W. M. S. and Yeung, R. M. W. (2002), “Trust building in livestock farmers: an exploratory study”, *Nutrition & Food Science*, Vol. 32 No.4, pp. 137-144.

Yeung, R. M. W. (2000a), “Food safety: consumer perception and risk reduction”, *First Postgraduate Research Conference, Cranfield University*, June.

Yeung, R. M. W. (2000b), “Food safety: consumer risk perception and risk reduction”, *Food Safety in Europe – Challenges and Opportunities Conference, London*, October.

Yeung, R. M. W. (2001), “Food safety: consumer food purchase models”, *Second Postgraduate Research Conference, Cranfield University*, June.

Yeung, R. M. W. and Morris, J. (2001a), “Food safety risk: consumer perception and purchase behaviour”, *British Food Journal*, Vol. 103 No. 3, pp. 170-186.

Yeung, R. M. W. and Morris, J. (2001b), “Consumer perception of food risk in chicken meat”, *Nutrition & Food Science*, Vol. 31 No. 6, pp. 270-278.

Zikmund, W. and Scott, J. (1977), “An investigation of the role of product characteristics in risk perception”, *Review of Business & Economic Research*, Vol. 13, pp. 19-34.

Zoonoses Report U K (1998), *Ministry of Agriculture, Fisheries and Food.*

Appendix 1 Criteria for Data Screening Prior to Using Principal Component Analysis (PCA)

The following criteria for data screening prior to using Principal Component Analysis were tested.

- Normality and linearity

The first criterion is normality and linearity. However Tabachnick and Fidell (1966) point out that the assumptions regarding the distribution of variables are not in force as long as it is used to summarise the relationship of observed variables. So, if variables are normally distributed, the solution is enhanced, on the other hand, if normality fails, the solution is degraded but may still be worthwhile.

- Multicollinearity and singularity

Multicollinearity occurs when the correlation between two variables is unity or nearly unity, and when they have a similar correlation pattern with the other variables. Singularity occurs when one variable is a linear or nearly linear combination of other variables. The presence of multicollinearity and singularity in multivariate analysis gives rise to unstable matrix inversion. In factor analysis, if any eigenvalues are negative, or are nearly zero with several decimal places, the presence of multicollinearity and singularity is suspected. The determinant of the correlation matrix and the eigenvalues were checked to ensure the absence of multicollinearity and singularity.

- Factorability of the correlation matrix

A matrix, which can be factorised, should include several sizeable correlations. Each and every entry in the correlation matrix will be checked to ensure that there are a few variables with correlation greater than the guideline of 0.30 (Tabachnick and Fidell, 1996, p 641). Furthermore, Kaiser-Mayer-Olkin Measure of Sampling Adequacy (KMO) was used to test the reliability of the relationship between pair of variables.

Appendix 2 Correlation Matrix for Risk Characteristics

	NOWLED(	IMPACT	:ONSEQU	INFO	SAFETY	MEDIA	SCIENCE	NSTRUCT
KNOWLED	1.000	.592	.270	-.240	.218	-.064	.247	.129
IMPACT	.592	1.000	.369	-.079	.330	-.148	.309	.138
CONSEQU	.270	.369	1.000	.092	.537	-.147	.337	.033
INFO	-.240	-.079	.092	1.000	.054	.236	-.111	-.082
SAFETY	.218	.330	.537	.054	1.000	-.181	.268	.052
MEDIA	-.064	-.148	-.147	.236	-.181	1.000	-.070	-.052
SCIENCE	.247	.309	.337	-.111	.268	-.070	1.000	.260
INSTRUCT	.129	.138	.033	-.082	.052	-.052	.260	1.000
WELLCOC	.278	.282	.137	-.005	.114	-.107	.320	.557
REGULAT	.100	.187	.238	.048	.312	-.189	.343	.263
ADEQ.REC	.075	.106	-.082	-.112	-.074	.031	.087	.152
ENFORCE	.049	.031	-.065	-.106	-.046	-.028	-.015	.082
GOV.AGEN	-.016	-.090	-.067	-.030	.010	-.054	-.261	-.107
ACTIVIST	.050	.109	.030	.023	.137	-.244	-.105	-.034
PRODUCE	.162	.223	.106	-.010	.159	-.221	.193	.074
VOLUNTA	-.020	-.130	-.047	-.071	.091	.012	.021	.178
H.INFO	-.083	-.066	.103	.196	.109	-.037	.015	-.027
FUTURE	-.008	.034	.146	.018	.157	-.137	.065	.126
ENVIRON	-.025	.063	.227	.050	.150	-.154	.064	.018
SPREAD	.084	.084	.171	-.101	.171	-.225	-.004	.094
S.QUICK	.116	.225	.199	-.003	.091	-.051	.275	.226
CONTRO.E	.021	.076	.029	-.045	.028	.044	-.067	-.133
CONTRO.C	.041	.098	.092	-.035	.045	-.076	.046	.089
INCREASE	-.023	.087	.188	-.004	.222	-.112	.006	.143
PEO.RISK	.041	.228	.273	-.039	.223	-.171	.197	.211

	/ELLCOO	REGULAT	ADEQ.REC	ENFORCE	GOV.AGEN	ACTIVIST	RODUCE	OLUNTAF
KNOWLED	.278	.100	.075	.049	-.016	.050	.162	-.020
IMPACT	.282	.187	.106	.031	-.090	.109	.223	-.130
CONSEQU	.137	.238	-.082	-.065	-.067	.030	.106	-.047
INFO	-.005	.048	-.112	-.106	-.030	.023	-.010	-.071
SAFETY	.114	.312	-.074	-.046	.010	.137	.159	.091
MEDIA	-.107	-.189	.031	-.028	-.054	-.244	-.221	.012
SCIENCE	.320	.343	.087	-.015	-.261	-.105	.193	.021
INSTRUCT	.557	.263	.152	.082	-.107	-.034	.074	.178
WELLCOC	1.000	.230	.103	.036	-.257	.022	.066	.036
REGULAT	.230	1.000	-.014	.004	-.031	.132	.314	.206
ADEQ.RE(	.103	-.014	1.000	.661	.291	-.053	-.019	.057
ENFORCE	.036	.004	.661	1.000	.363	.005	-.014	.113
GOV.AGE	-.257	-.031	.291	.363	1.000	.199	.056	.252
ACTIVIST	.022	.132	-.053	.005	.199	1.000	.330	.153
PRODUCE	.066	.314	-.019	-.014	.056	.330	1.000	.076
VOLUNTA	.036	.206	.057	.113	.252	.153	.076	1.000
H.INFO	-.071	.179	-.186	-.227	-.019	.136	.263	.084
FUTURE	.042	.281	-.129	-.201	.070	.177	.254	.209
ENVIRON	.046	.328	-.090	-.082	.012	.210	.268	.098
SPREAD	-.014	.239	-.237	-.175	-.009	.180	.127	.149
S.QUICK	.253	.280	-.027	-.129	-.118	.062	.145	.116
CONTRO.	-.083	.008	-.083	-.164	.052	.137	-.003	.095
CONTRO.	.086	.134	-.149	-.105	-.081	.074	.073	-.041
INCREASE	.105	.326	-.185	-.239	.002	.077	.030	.198
PEO.RISK	.179	.301	-.185	-.171	-.083	.191	.211	.031

Appendix 2 Correlation Matrix for Risk Characteristics (cont.)

	H.INFO	FUTURE	ENVIRON	SPREAD	S.QUICK	CONTRO.E	CONTRO.Q	INCREASE	PEO.RISK
KNOWLED	.592	.270	-.025	.084	.116	.021	.041	-.023	.041
IMPACT	1.000	.369	.063	.084	.225	.076	.098	.087	.228
CONSEQU	.369	1.000	.227	.171	.199	.029	.092	.188	.273
INFO	-.079	.092	.050	-.101	-.003	-.045	-.035	-.004	-.039
SAFETY	.330	.537	.150	.171	.091	.028	.045	.222	.223
MEDIA	-.148	-.147	-.154	-.225	-.051	.044	-.076	-.112	-.171
SCIENCE	.309	.337	.064	-.004	.275	-.067	.046	.006	.197
INSTRUCT	.138	.033	.018	.094	.226	-.133	.089	.143	.211
WELLCOO	.282	.137	.046	-.014	.253	-.083	.086	.105	.179
REGULAT	.187	.238	.328	.239	.280	.008	.134	.326	.301
ADEQ.REG	.106	-.082	-.090	-.237	-.027	-.083	-.149	-.185	-.185
ENFORCE	.031	-.065	-.082	-.175	-.129	-.164	-.105	-.239	-.171
GOV.AGEN	-.090	-.067	.012	-.009	-.118	.052	-.081	.002	-.083
ACTIVIST	.109	.030	.210	.180	.062	.137	.074	.077	.191
PRODUCE	.223	.106	.268	.127	.145	-.003	.073	.030	.211
VOLUNTAR	-.130	-.047	.098	.149	.116	.095	-.041	.198	.031
H.INFO	-.066	.103	.269	.233	.204	.067	.052	.229	.133
FUTURE	.034	.146	.621	.379	.405	.169	.155	.483	.276
ENVIRON	.063	.227	1.000	.510	.323	.267	.317	.402	.273
SPREAD	.084	.171	.510	1.000	.315	.301	.296	.470	.361
S.QUICK	.225	.199	.323	.315	1.000	.154	.224	.445	.399
CONTRO.E	.076	.029	.267	.301	.154	1.000	.573	.255	.114
CONTRO.Q	.098	.092	.317	.296	.224	.573	1.000	.286	.305
INCREASE	.087	.188	.402	.470	.445	.255	.286	1.000	.480
PEO.RISK	.133	.276	.273	.361	.399	.114	.305	.480	1.000

Appendix 3 Assumptions of Using Structural Equation Modelling (SEM)

Since path analysis plays an important part in the application of Structural Equation Modelling (SEM), the following assumptions should be fulfilled:

- Concomitant variation: non-zero correlation among the items measuring food risk characteristics, risk perception, risk reduction and purchase likelihood.

- Temporal asymmetry: food risk characteristics, that is the causal factors exist for developing risk perception and subsequently lead to future purchase likelihood.

- Relationship existence: this study rules out all other possible causal factors such as value, satisfaction for estimating the effect of risk perception.

Appendix 4 Measurement Submodel

The measurement submodel is a series of regression equations linking measures to factors.

$Y = \Lambda_y\eta + \varepsilon$ for the endogenous variables (A.1)
$X = \Lambda_x\xi + \delta$ for the exogenous variables (A.2)

Where X and Y are factor pattern matrix,
η is the vector of endogenous variables,
ξ is the vector of exogenous variables,
ε and δ are the residuals for the observed measures.
Λ_y is a matrix of factor loading between y and η
Λ_x is a matrix of factor loading between x and ξ

To be able to work with the residual variance/covariance matrices, the equations for X and Y are expressed in terms of variance/covariance matrices of observed measures and the equation of X (equation A.2) is transformed into

$\Sigma_{xx} = \Lambda_x \Phi \Lambda_x' + \Theta_\delta$ (A.3)

Where Φ is the factor variance/covariance matrix of the expected value of $\xi\xi'$ and
Θ_δ is the variance/covariance matrix of expected value of $\delta\delta'$.
Λ_x is a matrix of factor loading between x and ξ
Σ_{xx} is variance/covariance matrices for X

This equation is similar for Y.

Appendix 5 Structural Submodel

The structural submodel is the regression part of the latent variables in SEM. The equation is

$$\eta = B\,\eta + \Gamma\,\xi + \zeta \qquad \text{(A.4)}$$

Where B is the matrix of regression weights interrelating endogenous variables (η),
Γ is the matrix of regression weights relating exogenous variables (ξ) to endogenous variables (η), and
ζ is the vector of residuals for the endogenous latent variables (η).
Similarly, covariance structure ($\Sigma_{\eta\eta}$') can be expressed as

$$\Sigma_{\eta\eta}' = (I - B)^{-1}\,\Gamma\,\Phi\,\Gamma''(I - B)^{-1'} + (I - B)^{-1'}\,\Psi\,(I - B)^{-1'} \qquad \text{(A.5)}$$

Where B is a matrix of regression coefficients among the η
Γ is a matrix of regression coefficients between η and ξ
Φ is a variance-covariance matrix of the ξ
Ψ is a variance-covariance matrix of the structural errors (ζ) of the η
I is an identity matrix

Appendix 6 Path Diagram in SEM

Path diagram is useful for displaying graphically the pattern of causal relationships among set of observable and latent variables in SEM. Conventionally, the three components of a path diagram are rectangles, ellipse, and arrows.

Rectangles

Rectangles are used to indicate observed variables, which may be either observed variables of latent variables in the measurement submodel or independent variables in the structural submodel.

Ellipses

Ellipses are used to indicate latent variables, independent and dependent variables in the structural submodel and errors of measurement in the measurement submodel.

Arrows

Arrows are used to indicate association and are of two kinds.

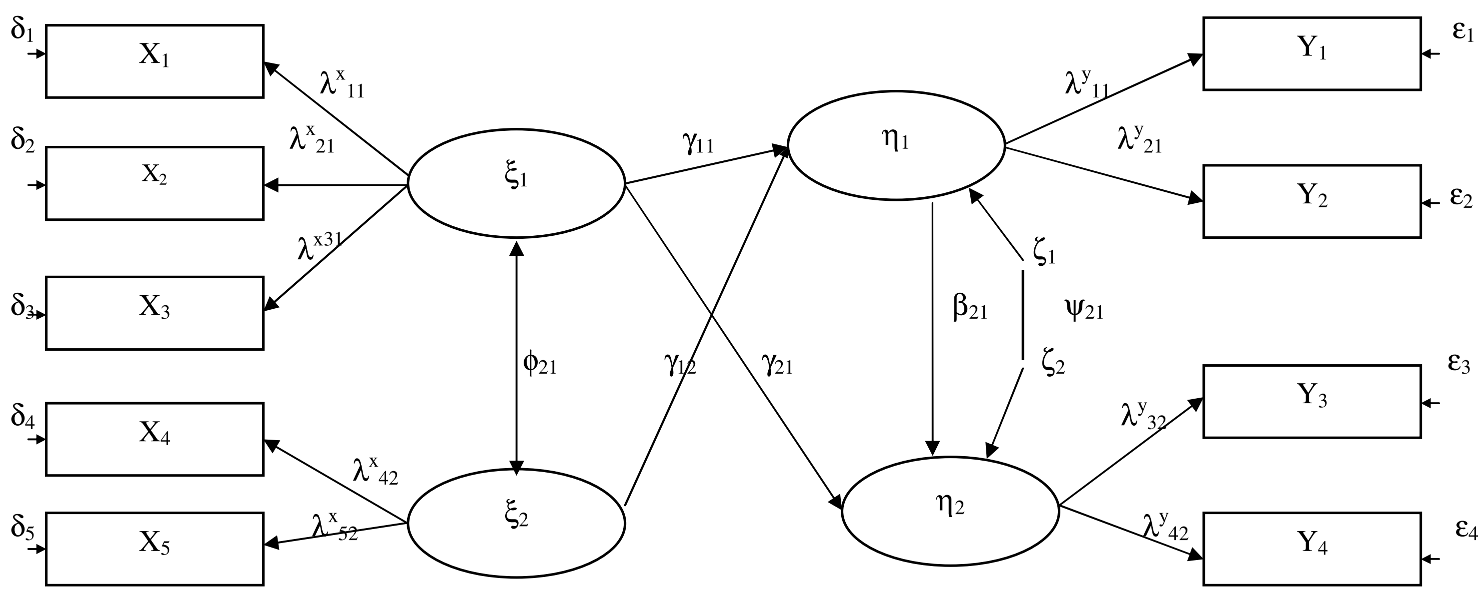
- Straight arrows point one direction and indicate direction of prediction, from predictor to outcome.

- Curve arrows point in two directions and indicate non-directional association (that is, correlation).

In a path diagram, the structural component of a model typically is arrayed so that directional arrows run from left to right shown in the following figure.

Furthermore, a path diagram that omits non-significant paths may be less cluttered than the full diagram but it contributes to incomplete reporting of results. A compromise is to report the non-significant paths with dashed lines.

Appendix 6 Path Diagram in SEM (cont.)



Appendix 6 Path Diagram in SEM (cont.)

The following symbols are used in the diagram:

- x - observable exogenous variable
- y - observable endogenous variable
- ξ (ksi) - latent exogenous variable
- η (eta) - latent endogenous variable
- β (beta) coefficients - the effect of endogenous on endogenous variables
- γ (gamma) coefficients - the effect of exogenous on endogenous variables
- ϕ (phi) - correlation between latent exogenous variables
- ζ (zeta) - the error term for each equation relating to a set of exogenous and endogenous explanatory variables to an endogenous criterion variable
- λ (lambda) - the regression coefficient relating each observed variable to its latent variable
- δ (delta) - errors in the measurement of exogenous variables
- ε (epsilon) - errors in the measurement of endogenous variables

Appendix 7 Mathematical Equations of Path Diagram

Measurement Submodel Equations

Exogenous Variables

Observed Items		ξ_1	ξ_2		error
x_1	=	$\lambda^x_{11}\,\xi_1$		+	δ_1
x_2	=	$\lambda^x_{21}\,\xi_1$		+	δ_2
x_3	=	$\lambda^x_{31}\,\xi_1$		+	δ_3
x_4	=		$\lambda^x_{41}\,\xi_2$	+	δ_4
x_5	=		$\lambda^x_{51}\,\xi_2$	+	δ_5

Endogenous Variables

Observed Items		η_1	η_2		error
y_1	=	$\lambda^y_{11}\,\eta_1$		+	ε_1
y_2	=	$\lambda^y_{21}\,\eta_1$		+	ε_2
y_3	=		$\lambda^y_{31}\,\eta_2$	+	ε_3
y_4	=		$\lambda^y_{41}\,\eta_2$	+	ε_4

Where λ^x_{ij} is the factor loading between the i[th] observed item for
the exogenous variable (ξ) and the j[th] exogenous variable
λ^y_{ij} is the factor loading between the i[th] observed item for
the endogenous variable (η) and the j[th] endogenous variable
δ_i is the error for the i[th] observed item for the exogenous variable
ε_j is the error for the j[th] observed item for the endogenous variable

Structural Submodel Equations

Endogenous Variables		Exogenous Variables: ξ_1		ξ_2		Endogenous Variables: η_1	η_2		Error
η_1	=	$\gamma_{11}\xi_1$	+	$\gamma_{12}\,\xi_2$	+			+	ζ_1
η_2	=	$\gamma_{21}\xi_1$	+	$\gamma_{22}\,\xi_2$	+	η_1		+	ζ_2

Where γ_{ij} is the regression coefficient between the i[th] endogenous variable and
the j[th] exogenous variable
β_{ij} is the regression coefficient between the i[th] endogenous variable and
the j[th] endogenous variable
ζ_i is the structural error of the i[th] endogenous variable

Appendix 8 Reliability of Measurement Submodel

Item reliability

Item reliability of a single measurement Xi or Yi, denoted by ρ_{Xi} or ρ_{Yi}

$$\rho_{xi} = 1 - \mathrm{var}\,(\delta_{Xi}) \,/\, \mathrm{var}\,(X_i) \qquad \text{(A.7)}$$
$$\rho_{Yi} = 1 - \mathrm{var}\,(\varepsilon_{Yi}) \,/\, \mathrm{var}\,(Y_i) \qquad \text{(A.8)}$$

where i denotes the underlying true score and ε denotes the error of measurement.
δ_{Xi} denotes the error of indicator X_I
ε_{Yi} denotes the error of indicator Y_i
The guideline for adequate measurement of a factor by a given indicator is $\rho > 0.4$ (Bagozzi and Baumgartner, 1994).

Cronbach alpha

The formulae for finding the Cronbach alpha statistic is

$$\alpha = [\, N / (N-1)\,]\,[\, 1 - \Sigma\sigma_i^2 / \sigma_T^2\,] \qquad \text{(A.6)}$$

where N = number of items
σ_T^2 = variance of the total of all observed items
$\Sigma\sigma_i^2$ = sum of item variances

The general rule for acceptable reliability is that α should be greater than 0.70 (Peter, 1979).

Factor reliability

The factor reliability ($\rho_{\xi j}$) of n measures of a dimension ξ_j may be defined in terms of λ_{Xi} and the factor reliability ($\rho_{\eta j}$) of n measures of a dimension η_j may be defined in terms of λ_{Yi} as follows:

$$\rho_{\xi j} = [\, (\Sigma \lambda_{Xi})^2\, \mathrm{var}(\xi_j)\,] \,/\, [(\Sigma \lambda_{Xi})^2\, \mathrm{var}(\xi_j) + \Sigma\, \mathrm{var}(\delta_{Xi})\,] \qquad \text{(A.9)}$$
$$\rho_{\eta j} = [\, (\Sigma \lambda_{Yi})^2\, \mathrm{var}(\eta_j)\,] \,/\, [(\Sigma \lambda_{Yi})^2\, \mathrm{var}(\eta_j) + \Sigma\, \mathrm{var}(\varepsilon_{Yi})\,] \qquad \text{(A.10)}$$

Where λ_{Xi} is the regression weight of X_i
$\mathrm{var}(\xi_j)$ is the variance of the factor ξ_j
δ_{Xi} is the error of measurement associated with X_i
λ_{Yi} is the regression weight of Y_i
$\mathrm{var}(\eta_j)$ is the variance of the factor η_j
ε_{Yi} is the error of measurement associated with Y_i

The guideline for an acceptable reliability of a factor is greater than 0.5 (Hair, Anderson, Tatham and Black, 1992).

Appendix 9 Validity of Measurement Submodel

Convergent validity

Convergent validity indicates "the extent to which measurement scales designed to measure the same factor are related" (Dillon et al., 1994, p 325). This was assessed by two methods. Firstly, the paths from individual items to latent factors were evaluated to check whether they were statistically significant (i.e. $p < 0.01$), with parameter estimates 10 to 20 times as large as the standard errors (Doney and Cannon, 1997). Secondly, based on the exploratory factor analysis, each item should load highly on its hypothesised factor, with only low cross loading. From the measurement submodel, those items with loading less than 0.71 or cross-loaded with two or more factors were removed. Thus convergent validity could be satisfied.

Discriminant validity

Discriminant validity indicates the extent to which the measurement scale is unique (Dillon et al., 1994) and not simply a reflection of another variable (Churchill, 1979; Peter, 1979). This was assessed by two methods. Firstly, exploratory factor analysis was conducted to select items which have high loading on hypothesised factors with low cross loading. Secondly, discriminant validity was assessed by pairwise comparisons of the scales. Discriminant validity can be assessed for two estimated constructs by constraining the estimated correlation parameter between them to 1.0 and then performing a chi-square difference test on the values obtained for the constrained and unconstrained models. In other words, to satisfy the discriminant validity criteria, the fit of the model with the unconstrained correlation should be significantly better than the fit of the constrained model (Bagozzi and Philips, 1982; Sethi and King, 1994).

Cranfield UNIVERSITY Silsoe

Appendix 9 Validity of Measurement Submodel (cont.)

Average variance extracted

Since the measures of evaluation described above do not present evidence as to the amount of variance in the measurement submodel due to measurement error. That is, neither ρ_{yi} nor ρ_{η} fails to measure the amount of variance captured by the factor in relation to that due to measurement error (Dillon and Goldstein, 1984). By using the formula below, the average variance extracted for each factor ξ ($\rho_{vc(\xi j)}$) or η($\rho_{vc(\eta)}$) could be obtained.

$$\rho_{vc(\xi j)} = [\, \Sigma\, \lambda_{Xi}^{2}\, \mathrm{var}(\xi_j)\,] \,/\, [\Sigma\, \lambda_{Xi}^{2}\, \mathrm{var}(\xi_j) + \Sigma\, \mathrm{var}(\delta_{Xi})\,] \qquad \text{(A.11)}$$

$$\rho_{vc(\eta j)} = [\, \Sigma\, \lambda_{Yi}^{2}\, \mathrm{var}(\eta_j)\,] \,/\, [\Sigma\, \lambda_{Yi}^{2}\, \mathrm{var}(\eta_j) + \Sigma\, \mathrm{var}(\varepsilon_{Yi})\,] \qquad \text{(A.12)}$$

Where λ_{Xi}^{2} is the unstandardised regression weight for X_i
$\mathrm{var}(\xi_j)$ is the variance of the factor ξ_j
δx_i is the error of measurement associated with X_i
λ_{Yi}^{2} is the unstandardised regression weight for Y_i
$\mathrm{var}(\eta_j)$ is the variance of the factor η_j
ε_{Yi} is the error of measurement associated with Y_i

If ρ_{vc} is less than 0.5, that is the variance due to measurement error is greater than that captured by the construct, so the validity of the individual indicator as well as the factor is questionable (Fornell and Larcker, 1981; Dillon and Goldstein, 1984).

Appendix 10 Validity of Structural Submodel

Total coefficient of determination

The total coefficient of determination for structural equation is a measure of the strength of several relationships jointly (Joreskog and Sorbom, 1998). It indicates that the percentage of the variation in the dependent variables is explained by the other variables in the model (Taylor, 1994). It is defined as

$$1 - |\Psi| / |\text{cov}(\eta)| \qquad \text{(A.13)}$$

Where Ψ is the variance-covariance matrix of the structure error of η
cov (η) is the covariance matrix of η

The coefficient lies between 0 and 1, and large values being associated with good nomological validity, however, the value over 0.25 is acceptable (Dillon and Goldstein, 1984; Taylor, 1994).

Appendix 11 Indices for Absolute Fit

Chi-square (χ^2)

Most common index of fit is χ^2 goodness of fit test. It is the product of the value of the fitting function and the sample size minus one. For generally weighted least-squares estimation method used in this study, the fitting function is:

$$F = (s - \sigma)' W^{-1} (s - \sigma)$$

Where s' is a vector of the elements in the lower half, including the diagonal, of the covariance matrix S used to fit the model to the data

σ' is the vector of corresponding elements of the covariance structure Σ reproduced from the model

W is the weight matrix

In practice, the χ^2 test may be of limited usefulness because the value of χ^2 is sensitive to sample size and thus gives a false indication (Fornell and Larcker, 1981). It is therefore very unlikely to obtain a non-significant test statistic with large sample size (Kelloway, 1995). To overcome this problem, there are other alternative absolute indices of fit (Bagozzi and Baumgartner, 1994).

Goodness-of-fit index (GFI)

The goodness-of-fit index is based on a ratio of the sum of the square discrepancies to the observed variances. The GFI ranges from 0 to 1, with values exceeding 0.9 indicating a good fit.

Adjusted goodness-of-fit index (AGFI)

The adjusted goodness-of-fit index adjusted the GFI for degree of freedom in the model. The AGFI ranges from 0 to 1, with values exceed 0.9 indicating a good fit.

Appendix 11 Indices for Absolute Fit (cont.)

Root mean squared error of approximation (RMSEA)

Similar to RMR, root mean squared error of approximation is based on the analysis of residuals with smaller values indicating a better fit. Any values below 0.10 indicate a good fit, below 0.05 indicate a very good fit, and below 0.01 indicate an outstanding fit.

Normed fit index (NFI)

Normed fit index is defined as

$$(\chi^2_{indep} - \chi^2_{model}) / \chi^2_{indep}$$

The NFI ranges from 0 to 1, with values exceeding 0.9 indicating a good fit because it indicates the percentage improvement in fit over the baseline of the "independence" model. So 0.9 implies that the model is 90% better fitting than the "independence" model.

Non-normed fit index (NNFI)

The non-normed fit index is similar to NFI but adjust the index for the number of degrees of freedom. It is defined as

$$(\chi^2_{indep} - (df_{indep} / df_{model}) \chi^2_{indep}) / (\chi^2_{indep} - df_{model})$$

The NNFI has a lower bound of 0 with no upper bound values. Higher value of the index indicates a better fit, and 0.9 is an indication of a good fit.

Appendix 12 Indices for Comparative Fit

Incremental fit index (IFI)

The incremental fit index is defined as:

$$(\chi^2_{indep} - \chi^2_{imodel}) / (\chi^2_{indep} - df_{model})$$

The values of IFI range between 0 and 1, with higher values indicating a better fit.

Comparative fit index (CFI)

The comparative fit index is based on the non-central χ^2 distribution and is defined as:

$$1 - [(\chi^2_{indep} - df_{model}) / (\chi^2_{indep} - df_{indep})]$$

The values of CFI range between 0 and 1, with values exceeding 0.90 indicating a good fit.

Relative fit index (RFI)

The relative fit index is defined as:

$$\{(\chi^2_{indep} - \chi^2_{model}) - [df_{indep} - (df_{model} / n)]\} / \{\chi^2_{indep} - (df_{indep} / n)\}$$

The values of RFI range between 0 and 1 with values greater than 0.90 indicating a good fit.

Appendix 13 Indices for Parsimonious Fit

Parsimonious normed fit index (PNFI)

The parsimonious normed index adjusts the NFI for model parsimony. It is defined as:

$$(df_{model} / df_{indep}) \times NFI$$

The PNFI ranges between 0 and 1, with higher values indicating a more parsimonious fit.

Parsimonious goodness-of-fit index (PGFI)

The parsimonious goodness-of-fit index adjusts the GFI for the degree of freedom in the model and is defined as

$$1 - (P/N) \times GFI$$

Where P = the number of estimated parameters in the model, and
N = the number of samples

The values of PGFI range between 0 and 1, with higher values indicating a more parsimonious fit.

Appendix 14 Power Estimates of Close Fit

	Sample Size		
Degree of freedom	**100**	**200**	**300**
60	0.477	0.831	0.960
70	0.525	0.877	0.978
80	0.570	0.911	0.988
90	0.612	0.937	0.994
100	0.650	0.955	0.997

Source: MacCallum, Browne and Sugawara (1996).

Appendix 15 Record of Conducting Quantitative Survey

Date (day of the week)	Time of the day	Place
June 5, 2000 (Monday)	morning	Girvan
6, 2000 (Tuesday)	morning	Ayr
6, 2000 (Tuesday)	afternoon	Ayr
6, 2000 (Tuesday)	evening	Ayr
7, 2000 (Wednesday)	afternoon	Cameron
8, 2000 (Thursday)	morning	Ayr
8, 2000 (Thursday)	afternoon	Ayr
8, 2000 (Thursday)	evening	Ayr
9, 2000 (Friday)	afternoon	Ayr
10, 2000 (Saturday)	afternoon	Blackpool
18, 2000 (Sunday)	afternoon	Flitwick
21, 2000 (Wednesday)	evening	Flitwick
23, 2000 (Friday)	morning	Sharnbrook
26, 2000 (Monday)	afternoon	Sharnbrook
29, 2000 (Thursday)	morning	Silsoe
30, 2000 (Friday)	afternoon	Flitwick
July 13, 2000 (Thursday)	afternoon	Archway
15, 2000 (Saturday)	afternoon	Newbury Park
16, 2000 (Sunday)	morning	Newbury Park
17, 2000 (Monday)	morning	Ilford
18, 2000 (Tuesday)	afternoon	Ilford
24, 2000 (Monday)	morning	Gospel Oak
25, 2000 (Tuesday)	afternoon	East Finchley
Aug 1, 2000 (Tuesday)	afternoon	Highgate
5, 2000 (Saturday)	morning	Central Bedford
15, 2000 (Tuesday)	evening	South Bedford
16, 2000 (Wednesday)	morning	South Bedford
17, 2000 (Thursday)	afternoon	South Bedford
19, 2000 (Saturday)	afternoon	Central Bedford
28, 2000 (Monday)	morning	North Bedford
28, 2000 (Monday)	afternoon	Central Bedford

Appendix 16 Descriptive Statistics of Measurement Items

Risk Characteristics

	N	Percentiles		
		25%	Median	75%
KNOWLEDG	200	4.0000	5.0000	6.0000
IMPACT	200	5.0000	6.0000	7.0000
CONSEQUE	200	5.0000	6.0000	7.0000
INFO	200	4.0000	5.0000	7.0000
SAFETY	200	4.0000	5.0000	7.0000
MEDIA	200	3.0000	4.0000	5.0000
SCIENCE	200	5.0000	6.0000	7.0000
INSTRUCT	200	5.0000	6.0000	7.0000
WELLCOOK	200	6.0000	6.0000	7.0000
REGULAT	200	4.0000	5.0000	6.0000
ADEQ.REG	200	3.0000	4.0000	4.0000
ENFORCE	200	2.0000	4.0000	4.0000
GOV.AGEN	200	1.2500	3.0000	4.0000
ACTIVIST	200	3.0000	4.0000	5.0000
PRODUCER	200	4.0000	5.0000	6.0000
VOLUNTAR	200	1.0000	3.0000	6.0000
H.INFO	200	4.0000	5.0000	6.0000
FUTURE	200	4.0000	4.0000	6.0000
ENVIRON	200	4.0000	4.0000	6.0000
SPREAD	200	4.0000	5.0000	6.0000
S.QUICK	200	4.0000	6.0000	7.0000
CONTRO.E	200	4.0000	4.5000	6.0000
CONTRO.Q	200	4.0000	4.0000	6.0000
INCREASE	200	4.0000	5.0000	6.0000
PEO.RISK	200	4.0000	5.0000	6.0000

Appendix 16 Descriptive Statistics of Measurement Items (cont.)

Risk Perception and Purchase Likelihood

	N	Percentiles 25%	Median	75%
L.SICK	200	3.5000	4.5000	6.0000
L.HEALTH	200	4.0000	5.0000	6.0000
LONGTERM	200	3.5000	4.0000	5.5000
L.MONEY	200	4.0000	4.5000	6.0000
L.INCOME	200	3.0000	4.0000	6.0000
L.TIME	200	3.5000	4.7500	6.0000
L.SOCIAL	200	2.1250	4.0000	5.0000
L.PSYCHO	200	3.5000	5.0000	6.0000
L.LIFEST	200	2.5000	4.0000	5.0000
L.TASTE	200	3.0000	4.0000	5.5000
PURCHASE	200	2.0000	3.0000	5.0000

Appendix 16 Descriptive Statistics of Measurement Items (cont.)

Risk Reduction

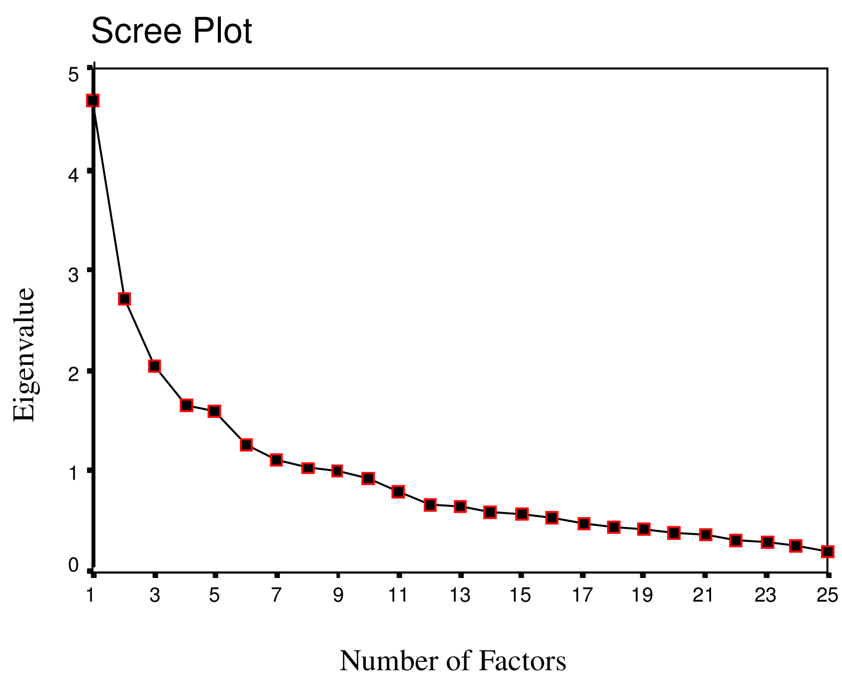
	N	Percentiles		
		25%	Median	75%
LOYALTY	200	4.0000	5.0000	6.0000
BRAND	200	4.0000	6.0000	7.0000
MON.BACK	200	2.0000	4.0000	5.7500
QUALITY	200	5.0000	6.0000	7.0000
GOV.LAB	200	4.0000	5.0000	6.0000
PRIV.LAB	200	3.0000	4.0000	5.0000
TRACEABI	200	4.0000	5.0000	6.0000
P.REDUCE	200	1.0000	3.0000	4.0000
ORGANIC	200	4.0000	5.0000	6.0000
SHOPPING	200	2.0000	4.0000	5.0000
AVAILABL	200	3.0000	5.0000	6.0000
ADVICE	200	3.0000	5.0000	6.0000
GUIDES	200	5.0000	6.0000	7.0000
LEAFLET	200	4.0000	5.0000	6.0000
SELFINSP	200	5.0000	6.0000	7.0000
KEEPCOLD	200	6.2500	7.0000	7.0000
SEPARATE	200	6.0000	7.0000	7.0000

Appendix 17 Kaiser's Criterion - Total Variance Explained for Risk Characteristics

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.694	18.776	18.776	4.694	18.776	18.776	2.886	11.545	11.545
2	2.730	10.919	29.695	2.730	10.919	29.695	2.248	8.991	20.535
3	2.046	8.184	37.878	2.046	8.184	37.878	2.043	8.172	28.708
4	1.655	6.620	44.499	1.655	6.620	44.499	1.978	7.912	36.620
5	1.605	6.421	50.920	1.605	6.421	50.920	1.974	7.895	44.515
6	1.269	5.074	55.994	1.269	5.074	55.994	1.751	7.004	51.518
7	1.126	4.505	60.499	1.126	4.505	60.499	1.540	6.161	57.679
8	1.021	4.082	64.581	1.021	4.082	64.581	1.374	5.494	63.174
9	1.000	4.001	68.582	1.000	4.001	68.582	1.352	5.408	68.582
10	.912	3.649	72.230						
11	.794	3.176	75.406						
12	.667	2.669	78.075						
13	.649	2.597	80.673						
14	.594	2.375	83.048						
15	.563	2.250	85.298						
16	.524	2.097	87.395						
17	.469	1.875	89.270						
18	.441	1.766	91.036						
19	.417	1.666	92.702						
20	.380	1.520	94.222						
21	.372	1.490	95.712						
22	.321	1.285	96.997						
23	.287	1.149	98.145						
24	.252	1.009	99.154						
25	.211	.846	100.000						

Extraction Method: Principal Component Analysis.

Appendix 18 Number of Factors for Risk Characteristics Based on Scree Test



Appendix 18 Number of Factors for Risk Characteristics Based on Scree Test (cont.)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.694	18.776	18.776	4.694	18.776	18.776	4.120	16.480	16.480
2	2.730	10.919	29.695	2.730	10.919	29.695	3.265	13.059	29.539
3	2.046	8.184	37.878	2.046	8.184	37.878	2.085	8.339	37.878
4	1.655	6.620	44.499						
5	1.605	6.421	50.920						
6	1.269	5.074	55.994						
7	1.126	4.505	60.499						
8	1.021	4.082	64.581						
9	1.000	4.001	68.582						
10	.912	3.649	72.230						
11	.794	3.176	75.406						
12	.667	2.669	78.075						
13	.649	2.597	80.673						
14	.594	2.375	83.048						
15	.563	2.250	85.298						
16	.524	2.097	87.395						
17	.469	1.875	89.270						
18	.441	1.766	91.036						
19	.417	1.666	92.702						
20	.380	1.520	94.222						
21	.372	1.490	95.712						
22	.321	1.285	96.997						
23	.287	1.149	98.145						
24	.252	1.009	99.154						
25	.211	.846	100.000						

Extraction Method: Principal Component Analysis.

Appendix 18 Number of Factors for Risk Characteristics Based on Scree Test (cont.)

Factor Loading

	Component		
	1	2	3
KNOWLEDG	-9.02E-02	.604	8.856E-02
IMPACT	2.058E-02	.696	2.967E-02
CONSEQUE	.226	.528	-.110
INFO	7.147E-02	-.161	-.225
SAFETY	.247	.465	3.470E-02
MEDIA	-.226	-.226	-.232
SCIENCE	-1.21E-02	.681	-8.81E-02
INSTRUCT	2.568E-02	.507	.123
WELLCOOK	-4.35E-02	.648	-2.91E-02
REGULAT	.408	.444	.169
ADEQ.REG	-.357	.145	.657
ENFORCE	-.348	6.570E-02	.726
GOV.AGEN	5.889E-02	-.287	.700
ACTIVIST	.360	-7.49E-03	.350
PRODUCER	.323	.263	.260
VOLUNTAR	.262	-4.38E-02	.444
H.INFO	.515	-9.02E-02	-6.63E-02
FUTURE	**.731**	5.242E-02	.111
ENVIRON	**.723**	6.925E-02	.117
SPREAD	.690	7.582E-02	7.935E-03
S.QUICK	.490	.371	-5.21E-02
CONTRO.E	.454	-.131	-5.31E-02
CONTRO.Q	.459	8.578E-02	-.141
INCREASE	.698	.129	-6.00E-02
PEO.RISK	.526	.358	-9.94E-02

Extraction Method: Principal Component Analysis.

Appendix 19 Correlation Matrix of Measurement Items for Risk Characteristics

Correlation Matrix to be analysed

	L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
L.HEALTH	1.00					
L.MONEY	0.69	1.00				
L.TIME	0.70	0.76	1.00			
L.LIFEST	0.65	0.55	0.65	1.00		
L.TASTE	0.46	0.45	0.46	0.54	1.00	
PURCHASE	-0.27	-0.19	-0.29	-0.27	-0.25	1.00
KNOWLEDG	0.01	0.10	0.15	0.17	0.08	0.12
CONSEQUE	0.31	0.32	0.35	0.37	0.26	-0.32
CONCERN	0.36	0.33	0.34	0.32	0.25	-0.32
COOKINST	0.14	0.16	0.16	0.13	0.12	0.18
ADEQ.REQ	-0.19	-0.13	-0.14	-0.04	-0.12	0.17
ENFORCE	-0.14	-0.07	-0.10	0.01	-0.08	0.10
ACTIVIST	0.22	0.24	0.24	0.25	0.11	-0.23
VOLUNTAR	0.14	0.16	0.15	0.09	0.16	-0.22
FUTURE	0.35	0.29	0.31	0.30	0.18	-0.29
ENVIRON	0.35	0.34	0.34	0.35	0.18	-0.31
CONTRO.E	0.21	0.18	0.06	0.12	0.11	-0.09
CONTRO.Q	0.20	0.14	0.08	0.22	0.06	-0.14

Appendix 19 Correlation Matrix of Measurement Items for Risk Characteristics (cont.)

Correlation Matrix to be analysed

	KNOWLEDG	CONSEQUE	CONCERN	COOKINST	ADEQ.REQ	ENFORCE
KNOWLEDG	1.00					
CONSEQUE	0.32	1.00				
CONCERN	0.25	0.62	1.00			
COOKINST	0.16	0.11	0.12	1.00		
ADEQ.REQ	0.09	-0.11	-0.11	0.18	1.00	
ENFORCE	0.06	-0.09	-0.06	0.09	0.70	1.00
ACTIVIST	0.08	0.04	0.15	-0.02	-0.06	- -
VOLUNTAR	-0.03	-0.04	0.08	0.21	0.07	0.13
FUTURE	-0.02	0.19	0.19	0.14	-0.15	-0.22
ENVIRON	-0.04	0.25	0.16	0.02	-0.08	-0.10
CONTRO.E	0.03	0.05	0.03	-0.14	-0.09	-0.18
CONTRO.Q	0.04	0.12	0.05	0.10	-0.16	-0.12

	ACTIVIST	VOLUNTAR	FUTURE	ENVIRON	CONTRO.E	CONTRO.Q
ACTIVIST	1.00					
VOLUNTAR	0.17	1.00				
FUTURE	0.20	0.23	1.00			
ENVIRON	0.23	0.12	0.67	1.00		
CONTRO.E	0.14	0.12	0.20	0.31	1.00	
CONTRO.Q	0.08	-0.05	0.19	0.35	0.61	1.00

Appendix 20 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Characteristics

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.TIME	2	0
L.LIFEST	3	0
L.TASTE	4	0
PURCHASE	0	0

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
KNOWLEDG	5	0	0	0	0	0
CONSEQUE	0	6	0	0	0	0
SAFETY	0	7	0	0	0	0
COOKINST	0	0	8	0	0	0
ADEQ.REQ	0	0	0	9	0	0
ENFORCE	0	0	0	10	0	0
ACTIVIST	0	0	0	0	11	0
VOLUNTAR	0	0	0	0	0	12
FUTURE	0	0	0	0	0	0
ENVIRON	0	0	0	0	0	0
CONTRO.E	0	0	0	0	0	0
CONTRO.Q	0	0	0	0	0	0

Appendix 20 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

LAMBDA-X

	adverse	uncontro
KNOWLEDG	0	0
CONSEQUE	0	0
SAFETY	0	0
COOKINST	0	0
ADEQ.REQ	0	0
ENFORCE	0	0
ACTIVIST	0	0
VOLUNTAR	0	0
FUTURE	13	0
ENVIRON	14	0
CONTRO.E	0	15
CONTRO.Q	0	16

BETA

	riskper	purchli
riskper	0	0
purchli	17	0

Appendix 20 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

GAMMA

	knowled	concern	owncon	legislat	influen	involunt
riskper	18	19	20	21	22	23
purchli	0	0	0	0	0	0

GAMMA

	adverse	uncontro
riskper	24	25
purchli	0	0

PHI

	knowled	concern	owncon	legislat	influen	involunt
knowled	0					
concern	26	0				
owncon	27	28	0			
legislat	29	30	31	0		
influen	32	33	34	35	0	
involunt	36	37	38	39	40	0
adverse	41	42	43	44	45	46
uncontro	47	48	49	50	51	52

Appendix 20 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

PHI

	adverse	uncontro
adverse	0	
uncontro	53	0

PSI
Note: This matrix is diagonal.

riskper	purchli
54	55

THETA-EPS

L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
56	57	58	59	60	0

THETA-DELTA

KNOWLEDG	CONSEQUE	SAFETY	COOKINST	ADEQ.REQ	ENFORCE
0	61	62	0	63	0

THETA-DELTA

ACTIVIST	VOLUNTAR	FUTURE	ENVIRON	CONTRO.E	CONTRO.Q
0	0	64	65	66	67

Appendix 21 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Characteristics

```
LISREL Estimates

        LAMBDA-Y

            riskper    purchli
           --------   --------
L.HEALTH       0.85        - -

 L.MONEY       0.82        - -
             (0.02)
              46.06

  L.TIME       0.86        - -
             (0.02)
              46.12

L.LIFEST       0.79        - -
             (0.02)
              33.75

 L.TASTE       0.70        - -
             (0.03)
              20.01

PURCHASE        - -       1.00
```

Appendix 21 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
KNOWLEDG	1.00 (0.04) 28.21	- -	- -	- -	- -	- -
CONSEQUE	- -	0.76 (0.04) 21.53	- -	- -	- -	- -
SAFETY	- -	0.75 (0.04) 20.07	- -	- -	- -	- -
COOKINST	- -	- -	1.00 (0.04) 28.21	- -	- -	- -
ADEQ.REQ	- -	- -	- -	0.57 (0.04) 15.57	- -	- -
ENFORCE	- -	- -	- -	1.00 (0.03) 30.61	- -	- -
ACTIVIST	- -	- -	- -	- -	1.00 (0.04) 28.21	- -

Appendix 21 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
VOLUNTAR	- -	- -	- -	- -	- -	1.00 (0.04) 28.21
FUTURE	- -	- -	- -	- -	- -	- -
ENVIRON	- -	- -	- -	- -	- -	- -
CONTRO.E	- -	- -	- -	- -	- -	- -
CONTRO.Q	- -	- -	- -	- -	- -	- -

LAMBDA-X

	adverse	uncontro
KNOWLEDG	- -	- -
CONSEQUE	- -	- -
SAFETY	- -	- -
COOKINST	- -	- -
ADEQ.REQ	- -	- -
ENFORCE	- -	- -

Appendix 21 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

```
LAMBDA-X

             adverse   uncontro
            --------   --------


 ACTIVIST       - -        - -

 VOLUNTAR       - -        - -

   FUTURE      0.88        - -
             (0.03)
              30.21

  ENVIRON      0.81        - -
             (0.03)
              31.12

 CONTRO.E       - -       0.63
                        (0.04)
                         14.07

 CONTRO.Q       - -       0.99
                        (0.06)
                         15.29
```

Appendix 21 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

```
        BETA

            riskper    purchli
           --------   --------
 riskper        - -        - -

 purchli      -0.60        - -
             (0.04)
             -15.96


        GAMMA

            knowled    concern     owncon   legislat    influen   involunt
           --------   --------   --------   --------   --------   --------
 riskper      -0.02       0.49      -0.03      -0.12       0.11       0.18
             (0.05)     (0.05)     (0.05)     (0.04)     (0.04)     (0.05)
              -0.39      10.79      -0.67      -2.93       2.48       3.34

 purchli        - -        - -        - -        - -        - -        - -


        GAMMA

            adverse   uncontro
           --------   --------
 riskper       0.45       0.04
             (0.05)     (0.04)
               8.92       1.10

 purchli        - -        - -
```

Appendix 22 Assessment of Discriminant Validity of Measurement Submodel – Risk Characteristics

	χ^2 (d.f.)		χ^2 (d.f.=1)
Factor	**Constrained model**	**Unconstrained model**	**Difference**
knowledge			
concern	35.20 (1)	-	35.20
own control	65.26 (1)	-	65.26
legislation	68.02 (1)	-	68.02
activist influence	106.83 (1)	-	106.83
involuntary	109.82 (1)	-	109.82
adverse effect	59.12 (1)	-	59.12
uncontrollable	47.20 (1)	-	47.20
risk perception	114.15 (10)	19.80 (9)	94.35
purchase likelihood	80.95 (1)	-	80.95
concern			
own control	57.74 (1)	-	57.74
legislation	76.03 (2)	0.28 (1)	75.75
activist influence	64.01 (1)	-	64.01
involuntary	87.49 (1)	-	87.49
adverse effect	35.29 (1)	0.67 (1)	34.62
uncontrollable	40.31 (2)	0.02 (1)	40.29
risk perception	57.52 (14)	16.59 (13)	40.93
purchase likelihood	37.35 (1)	-	37.35

Appendix 22 Assessment of Discriminant Validity of Measurement Submodel – Risk Characteristics (cont.)

Factor	χ^2 (d.f.) Constrained model	χ^2 (d.f.) Unconstrained model	χ^2 (d.f.=1) Difference
own control			
legislation	72.47 (1)	-	72.47
activist influence	117.81 (1)	-	117.81
involuntary	64.10 (1)	-	64.10
adverse effect	57.38 (1)	-	57.38
uncontrollable	54.97 (1)	-	54.97
risk perception	92.85 (10)	13.30 (9)	79.55
purchase likelihood	74.07 (1)	-	74.07
legislat			
activist influence	78.00 (1)	-	78.00
involuntary	66.72 (1)	-	66.72
adverse effect	63.09 (2)	0.06 (1)	63.03
uncontrollable	37.15 (2)	1.85 (1)	35.30
risk perception	119.60 (14)	25.10 (13)	94.50
purchase likelihood	74.12 (1)	-	74.12
activist influence			
involuntary	75.72 (1)	-	75.72
adverse effect	49.89 (1)	-	49.89
uncontrollable	42.41 (1)	-	42.41
risk perception	80.47 (10)	16.64 (9)	63.83
purchase likelihood	164.69 (1)	-	164.69

Appendix 22 Assessment of Discriminant Validity of Measurement Submodel – Risk Characteristics (cont.)

	χ^2 (d.f.)		χ^2 (d.f.=1)
Factor	**Constrained model**	**Unconstrained model**	**Difference**
involuntary			
adverse effect	49.05 (1)	-	49.05
uncontrollable	50.95 (1)	-	50.95
risk perception	113.70 (10)	15.87 (9)	97.83
purchase likelihood	165.53 (1)	-	165.53
adverse effect			
uncontrollable	26.12 (2)	0.14 (1)	25.98
risk perception	46.00 (14)	16.65 (13)	29.35
purchase likelihood	44.38 (1)	-	44.38
uncontrollable			
risk perception	72.10 (14)	29.05 (13)	42.95
purchase likelihood	44.63 (1)	-	44.63
risk perception			
purchase likelihood	228.30 (10)	18.65 (9)	209.65

All χ^2 differences are significant (for 1 degree of freedom) at the 0.01 level.

Appendix 23 Assessment of Factor Validity – Risk Characteristics

Factors Extracted	Average Variance
knowledge [knowled]	-
concern [concern]	0.57
own control [owncon]	-
legislation [legislat]	0.66
activist influence [influen]	-
involuntary [involunt]	-
adverse effect [adverse]	0.71
uncontrollable [uncontro]	0.68
risk perception [riskper]	0.65
purchase likelihood [purchli]	-

Appendix 24 Model Specification for Consumer Food Purchase Rival Model Linking with Risk Characteristics

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.TIME	2	0
L.LIFEST	3	0
L.TASTE	4	0
PURCHASE	0	0

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
KNOWLEDG	5	0	0	0	0	0
CONSEQUE	0	6	0	0	0	0
SAFETY	0	7	0	0	0	0
COOKINST	0	0	8	0	0	0
ADEQ.REQ	0	0	0	9	0	0
ENFORCE	0	0	0	10	0	0
ACTIVIST	0	0	0	0	11	0
VOLUNTAR	0	0	0	0	0	12
FUTURE	0	0	0	0	0	0
ENVIRON	0	0	0	0	0	0
CONTRO.E	0	0	0	0	0	0
CONTRO.Q	0	0	0	0	0	0

Appendix 24 Model Specification for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

LAMBDA-X

	adverse	uncontro
KNOWLEDG	0	0
CONSEQUE	0	0
SAFETY	0	0
COOKINST	0	0
ADEQ.REQ	0	0
ENFORCE	0	0
ACTIVIST	0	0
VOLUNTAR	0	0
FUTURE	13	0
ENVIRON	14	0
CONTRO.E	0	15
CONTRO.Q	0	16

BETA

	riskper	purchli
riskper	0	0
purchli	17	0

GAMMA

	knowled	concern	owncon	legislat	influen	involunt
riskper	0	18	0	19	20	21
purchli	24	0	25	0	0	0

Appendix 24 Model Specification for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

GAMMA

	adverse	uncontro
riskper	22	23
purchli	0	0

PHI

	knowled	concern	owncon	legislat	influen	involunt
knowled	0					
concern	26	0				
owncon	27	28	0			
legislat	29	30	31	0		
influen	32	33	34	35	0	
involunt	36	37	38	39	40	0
adverse	41	42	43	44	45	46
uncontro	47	48	49	50	51	52

PHI

	adverse	uncontro
adverse	0	
uncontro	53	0

Appendix 24 Model Specification for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

PSI

Note: This matrix is diagonal.

riskper	purchli
54	55

THETA-EPS

L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
56	57	58	59	60	0

THETA-DELTA

KNOWLEDG	CONSEQUE	SAFETY	COOKINST	ADEQ.REQ	ENFORCE
0	61	62	0	63	0

THETA-DELTA

ACTIVIST	VOLUNTAR	FUTURE	ENVIRON	CONTRO.E	CONTRO.Q
0	0	64	65	66	67

Appendix 25 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Characteristics

```
LISREL Estimates

         LAMBDA-Y

             riskper    purchli
            --------   --------
 L.HEALTH       0.86       - -

  L.MONEY       0.84       - -
              (0.02)
               48.47

   L.TIME       0.90       - -
              (0.02)
               46.12

 L.LIFEST       0.83       - -
              (0.02)
               35.00

  L.TASTE       0.70       - -
              (0.03)
               20.96

 PURCHASE        - -      1.00
```

Appendix 25 Parameter Estimates for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
KNOWLEDG	1.00 (0.04) 28.32	- -	- -	- -	- -	- -
CONSEQUE	- -	0.78 (0.04) 21.66	- -	- -	- -	- -
SAFETY	- -	0.73 (0.04) 20.19	- -	- -	- -	- -
COOKINST	- -	- -	1.01 (0.03) 28.78	- -	- -	- -
ADEQ.REQ	- -	- -	- -	0.63 (0.04) 15.39	- -	- -
ENFORCE	- -	- -	- -	0.97 (0.03) 29.44	- -	- -
ACTIVIST	- -	- -	- -	- -	1.00 (0.04) 28.15	- -
VOLUNTAR	- -	- -	- -	- -	- -	0.99 (0.03) 28.47

Appendix 25 Parameter Estimates for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

```
        LAMBDA-X

                adverse   uncontro
               --------   --------

  FUTURE          0.90        - -
                (0.03)
                 31.42

 ENVIRON          0.82        - -
                (0.02)
                 33.31

CONTRO.E          - -         0.67
                            (0.04)
                             15.72

CONTRO.Q          - -         0.96
                            (0.06)
                             17.40


        BETA

                riskper    purchli
               --------   --------
 riskper          - -         - -

 purchli         -0.62        - -
                (0.04)
                -16.95
```

Appendix 25 Parameter Estimates for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

GAMMA

	knowled	concern	owncon	legislat	influen	involunt
riskper	- -	0.49 (0.04) 12.25	- -	-0.10 (0.04) -2.54	0.11 (0.04) 2.67	0.23 (0.05) 4.65
purchli	0.17 (0.04) 4.52	- -	0.17 (0.04) 4.47	- -	- -	- -

GAMMA

	adverse	uncontro
riskper	0.44 (0.05) 9.47	0.09 (0.04) 2.33
purchli	- -	- -

Appendix 26 Modification Index for Consumer Food Purchase Model Linking with Risk Characteristics

Modification Indices for BETA

	riskper	purchli
riskper	- -	18.32[a]
purchli	- -	- -

Modification Indices for GAMMA

	knowled	concern	owncon	legislat	influen	involunt
riskper	4.26[b]	- -	1.87	- -	- -	- -
purchli	- -	0.12	- -	0.07	1.23	0.35

Modification Indices for GAMMA

	adverse	uncontro
riskper	- -	- -
purchli	1.04	1.08

[a] the path is against the existing theory
[b] same as the proposed model

Appendix 27 Standardised Residuals for Consumer Food Purchase Model Linking with Risk Characteristics

Standardized Residuals

	L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
L.HEALTH	- -					
L.MONEY	-0.86	- -				
L.TIME	-1.51	0.11	- -			
L.LIFEST	-1.51	-2.59	-2.11	- -		
L.TASTE	-2.39	-1.81	-2.23	-0.58	- -	
PURCHASE	2.95	3.57	2.82	2.32	1.62	- -
KNOWLEDG	-2.28	-1.03	-0.51	0.00	-0.86	0.83
CONSEQUE	-1.78	-1.43	-1.46	-0.71	-1.29	-1.11
SAFETY	-0.69	-0.90	-1.14	-0.96	-1.13	-1.37
COOKINST	-1.81	-1.39	-1.63	-1.71	-1.31	2.65
ADEQ.REQ	-1.54	-0.72	-0.83	0.43	-0.75	1.23
ENFORCE	-0.29	0.59	0.34	1.63	0.20	-0.19
ACTIVIST	-1.75	-1.43	-1.75	-1.04	-2.10	-0.43
VOLUNTAR	-1.31	-0.83	-1.21	-1.70	-0.29	-1.74
FUTURE	-2.77	-2.93	-3.45	-2.76	-2.98	0.60
ENVIRON	-1.98	-1.96	-2.27	-1.47	-2.68	-0.12
CONTRO.E	0.41	0.07	-1.64	-0.69	-0.48	0.32
CONTRO.Q	-0.81	-1.47	-2.55	-0.38	-2.06	0.31

Appendix 27 Standardised Residuals for Consumer Food Purchase Model Linking with Risk Characteristics (cont.)

Standardized Residuals

	KNOWLEDG	CONSEQUE	SAFETY	COOKINST	ADEQ.REQ	ENFORCE
KNOWLEDG	-0.19					
CONSEQUE	0.50	- -				
SAFETY	-0.14	0.95	- -			
COOKINST	0.38	-0.58	-0.33	-1.31		
ADEQ.REQ	0.81	-0.98	-1.06	1.18	- -	
ENFORCE	0.27	-0.61	-0.21	-0.51	1.42	0.41
ACTIVIST	-1.11	-0.91	0.73	-2.57	-0.91	-0.24
VOLUNTAR	-0.24	-0.56	1.06	-2.99	-0.95	-1.31
FUTURE	-0.80	0.00	0.16	-1.09	-1.18	-1.80
ENVIRON	-0.99	1.01	-0.02	-2.32	-0.33	-0.27
CONTRO.E	0.18	-0.37	-0.54	-2.86	0.01	-0.45
CONTRO.Q	0.22	0.09	-0.73	-0.01	-0.36	1.01

Standardized Residuals

	ACTIVIST	VOLUNTAR	FUTURE	ENVIRON	CONTRO.E	CONTRO.Q
ACTIVIST	1.16					
VOLUNTAR	-1.37	0.86				
FUTURE	-1.35	2.21	- -			
ENVIRON	-0.67	0.84	-0.93	- -		
CONTRO.E	0.42	2.45	0.11	1.73	- -	
CONTRO.Q	-1.01	0.88	-1.01	1.39	-0.36	- -

Appendix 28 Model Specification for Consumer Food Purchase Modified Model Linking with Risk Characteristics

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.TIME	2	0
L.LIFEST	3	0
L.TASTE	4	0
PURCHASE	0	0

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
KNOWLEDG	5	0	0	0	0	0
CONSEQUE	0	6	0	0	0	0
CONCERN	0	7	0	0	0	0
COOKINST	0	0	8	0	0	0
ADEQ.REQ	0	0	0	9	0	0
ENFORCE	0	0	0	10	0	0
ACTIVIST	0	0	0	0	11	0
VOLUNTAR	0	0	0	0	0	12
ENVIRON	0	0	0	0	0	0
CONTRO.E	0	0	0	0	0	0
CONTRO.Q	0	0	0	0	0	0

Appendix 28 Model Specification for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

LAMBDA-X

	adverse	uncontro
KNOWLEDG	0	0
CONSEQUE	0	0
CONCERN	0	0
COOKINST	0	0
ADEQ.REQ	0	0
ENFORCE	0	0
ACTIVIST	0	0
VOLUNTAR	0	0
ENVIRON	13	0
CONTRO.E	0	14
CONTRO.Q	0	15

BETA

	riskper	purchli
riskper	0	0
purchli	16	0

Appendix 28 Model Specification for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

GAMMA

	knowled	concern	owncon	legislat	influen	involunt
riskper	0	17	0	18	19	20
purchli	23	0	24	0	0	0

GAMMA

	adverse	uncontro
riskper	21	22
purchli	0	0

PHI

	knowled	concern	owncon	legislat	influen	involunt
knowled	0					
concern	25	0				
owncon	26	27	0			
legislat	28	29	30	0		
influen	31	32	33	34	0	
involunt	35	36	37	38	39	0
adverse	40	41	42	43	44	45
uncontro	46	47	48	49	50	51

Appendix 28 Model Specification for Consumer Food Purchase Rival Model – Risk Characteristics (cont.)

PHI

	adverse	uncontro
adverse	0	
uncontro	52	0

PSI
Note: This matrix is diagonal.

riskper	purchli
53	54

THETA-EPS

L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
55	56	57	58	59	0

THETA-DELTA

KNOWLEDG	CONSEQUE	CONCERN	COOKINST	ADEQ.REQ	ENFORCE
0	60	61	0	62	0

THETA-DELTA

ACTIVIST	VOLUNTAR	ENVIRON	CONTRO.E	CONTRO.Q
0	0	0	63	64

Appendix 29 Parameter Estimates for Consumer Food Purchase Modified Model Linking with Risk Characteristics

```
LISREL Estimates

         LAMBDA-Y

              riskper    purchli
              --------   --------
 L.HEALTH       0.87        - -

  L.MONEY       0.84        - -
              (0.02)
               38.00

   L.TIME       0.90        - -
              (0.03)
               35.38

 L.LIFEST       0.82        - -
              (0.03)
               30.10

  L.TASTE       0.70        - -
              (0.04)
               18.71

 PURCHASE        - -       1.00
```

Appendix 29 Parameter Estimates for Consumer Food Purchase Modified Model Linking with Risk Characteristics (cont.)

LAMBDA-X

	knowled	concern	owncon	legislat	influen	involunt
KNOWLEDG	1.00 (0.04) 28.33	- -	- -	- -	- -	- -
CONSEQUE	- -	0.79 (0.04) 19.04	- -	- -	- -	- -
SAFETY	- -	0.77 (0.04) 19.70	- -	- -	- -	- -
COOKINST	- -	- -	1.01 (0.04) 28.76	- -	- -	- -
ADEQ.REQ	- -	- -	- -	0.69 (0.05) 14.78	- -	- -
ENFORCE	- -	- -	- -	0.96 (0.03) 29.89	- -	- -
ACTIVIST	- -	- -	- -	- -	1.00 (0.04) 28.22	- -
VOLUNTAR	- -	- -	- -	- -	- -	0.99 (0.04) 28.00

Appendix 29 Parameter Estimates for Consumer Food Purchase Modified Model Linking with Risk Characteristics (cont.)

```
        LAMBDA-X

              adverse   uncontro
             --------   --------
 KNOWLEDG        - -        - -

 CONSEQUE        - -        - -

   SAFETY        - -        - -

 COOKINST        - -        - -

 ADEQ.REQ        - -        - -

  ENFORCE        - -        - -

 ACTIVIST        - -        - -

 VOLUNTAR        - -        - -

  ENVIRON       1.00        - -
              (0.04)
               28.26

 CONTRO.E        - -       0.67
                         (0.05)
                          14.64

 CONTRO.Q        - -       1.03
                         (0.07)
                          15.36
```

Appendix 29 Parameter Estimates for Consumer Food Purchase Modified Model Linking with Risk Characteristics (cont.)

```
        BETA

             riskper    purchli
            --------   --------
 riskper        - -        - -

 purchli       -0.57       - -
              (0.05)
              -11.54

        GAMMA

             knowled    concern     owncon   legislat    influen   involunt
            --------   --------   --------   --------   --------   --------
 riskper        - -       0.52        - -      -0.10       0.18       0.21
                        (0.04)                (0.04)     (0.04)     (0.05)
                         12.54                 -2.25       4.19       4.05

 purchli        0.14       - -        0.13       - -        - -        - -
              (0.04)               (0.04)
                3.29                  2.93

        GAMMA

             adverse   uncontro
            --------   --------
 riskper        0.30       0.11
              (0.04)     (0.04)
                6.76       2.80

 purchli        - -        - -
```

Appendix 30 Correlation Matrix for Risk Reduction

	LOYALTY	BRAND	MON.BACK	QUALITY	GOV.LAB	PRIV.LAB	TRACEABI	P.REDUCE	ORGANIC
LOYALTY	1.000	.605	.330	.456	.271	.192	.312	.085	.236
BRAND	.605	1.000	.432	.483	.389	.208	.259	.016	.330
MON.BACK	.330	.432	1.000	.463	.417	.336	.322	.182	.207
QUALITY	.456	.483	.463	1.000	.578	.392	.426	.095	.329
GOV.LAB	.271	.389	.417	.578	1.000	.663	.537	.122	.277
PRIV.LAB	.192	.208	.336	.392	.663	1.000	.469	.108	.311
TRACEABI	.312	.259	.322	.426	.537	.469	1.000	.041	.320
P.REDUCE	.085	.016	.182	.095	.122	.108	.041	1.000	.044
ORGANIC	.236	.330	.207	.329	.277	.311	.320	.044	1.000
SHOPPING	.056	-.008	.109	-.005	.040	.151	.008	.406	-.036
AVAILABL	.390	.455	.346	.377	.313	.186	.232	.245	.072
ADVICE	.298	.299	.241	.226	.259	.161	.224	.165	.259
GUIDES	.261	.302	.390	.419	.371	.319	.272	-.028	.201
LEAFLET	.187	.279	.309	.384	.301	.243	.229	.052	.192
SELFINSP	.200	.208	.275	.324	.179	.142	.203	.028	.159
KEEPCOLD	.293	.245	.176	.261	.108	.077	.169	.020	.178
SEPARATE	.265	.265	.197	.277	.121	.084	.155	-.089	.125

Appendix 30 Correlation Matrix for Risk Reduction (cont.)

	SHOPPING	AVAILABL	ADVICE	GUIDES	LEAFLET	SELFINSP	KEEPCOLD	SEPARATE
LOYALTY	.056	.390	.298	.261	.187	.200	.293	.265
BRAND	-.008	.455	.299	.302	.279	.208	.245	.265
MON.BACK	.109	.346	.241	.390	.309	.275	.176	.197
QUALITY	-.005	.377	.226	.419	.384	.324	.261	.277
GOV.LAB	.040	.313	.259	.371	.301	.179	.108	.121
PRIV.LAB	.151	.186	.161	.319	.243	.142	.077	.084
TRACEABI	.008	.232	.224	.272	.229	.203	.169	.155
P.REDUCE	.406	.245	.165	-.028	.052	.028	.020	-.089
ORGANIC	-.036	.072	.259	.201	.192	.159	.178	.125
SHOPPING	1.000	.247	.252	-.073	.072	.151	.071	-.040
AVAILABL	.247	1.000	.316	.147	.183	.243	.190	.156
ADVICE	.252	.316	1.000	.131	.180	.166	.128	.058
GUIDES	-.073	.147	.131	1.000	.639	.388	.258	.307
LEAFLET	.072	.183	.180	.639	1.000	.386	.136	.194
SELFINSP	.151	.243	.166	.388	.386	1.000	.464	.284
KEEPCOLD	.071	.190	.128	.258	.136	.464	1.000	.570
SEPARATE	-.040	.156	.058	.307	.194	.284	.570	1.000

Appendix 31 Total Variance Explained for Risk Reduction

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.123	30.134	30.134	5.123	30.134	30.134	2.622	15.426	15.426
2	1.764	10.379	40.513	1.764	10.379	40.513	2.532	14.894	30.320
3	1.582	9.306	49.819	1.582	9.306	49.819	2.084	12.256	42.576
4	1.286	7.563	57.382	1.286	7.563	57.382	1.873	11.017	53.593
5	1.042	6.130	63.512	1.042	6.130	63.512	1.686	9.919	63.512
6	.920	5.410	68.922						
7	.747	4.392	73.314						
8	.646	3.799	77.113						
9	.606	3.562	80.675						
10	.582	3.422	84.097						
11	.550	3.237	87.334						
12	.491	2.890	90.224						
13	.441	2.592	92.817						
14	.362	2.130	94.946						
15	.339	1.995	96.942						
16	.291	1.714	98.656						
17	.229	1.344	100.000						

Extraction Method: Principal Component Analysis.

Appendix 32 Correlation Matrix of Measurement Items for Risk Reduction

Correlation Matrix to be Analyzed

	L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
L.HEALTH	1.00					
L.MONEY	0.66	1.00				
L.TIME	0.66	0.73	1.00			
L.LIFEST	0.60	0.49	0.61	1.00		
L.TASTE	0.43	0.41	0.42	0.49	1.00	
PURCHASE	-0.24	-0.18	-0.25	-0.25	-0.25	1.00
LOYALTY	-0.29	-0.23	-0.23	-0.21	-0.27	0.13
W.BRAND	-0.30	-0.20	-0.16	-0.20	-0.23	0.19
GOV.LAB	-0.27	-0.21	-0.28	-0.32	-0.19	0.18
PRIV.LAB	-0.18	-0.15	-0.13	-0.22	-0.06	0.13
TRACEABI	-0.17	-0.15	-0.13	-0.16	-0.10	0.17
PRI.RED	0.03	-0.07	-0.11	-0.01	-0.10	-0.20
GUIDE	-0.28	-0.25	-0.18	-0.23	-0.07	0.17
LEAFLET	-0.16	-0.22	-0.18	-0.16	-0.04	0.19
KEEPCOLD	-0.13	0.01	-0.03	-0.05	-0.11	-0.05
SEPARATE	-0.13	0.01	-0.04	-0.08	-0.13	0.05

Appendix 32 Correlation Matrix of Measurement Items for Risk Reduction (cont.)

Correlation Matrix to be Analyzed (cont.)

	LOYALTY	W.BRAND	GOV.LAB	PRIV.LAB	TRACEABI	PRI.RED
LOYALTY	1.00					
W.BRAND	0.61	1.00				
GOV.LAB	0.27	0.39	1.00			
PRIV.LAB	0.19	0.21	0.66	1.00		
TRACEABI	0.31	0.26	0.54	0.47	1.00	
PRI.RED	0.08	0.02	0.12	0.11	0.04	1.00
GUIDE	0.26	0.30	0.37	0.32	0.27	-0.03
LEAFLET	0.19	0.28	0.30	0.24	0.23	0.05
KEEPCOLD	0.29	0.25	0.11	0.08	0.17	0.02
SEPARATE	0.27	0.27	0.12	0.08	0.16	-0.09

	GUIDE	LEAFLET	KEEPCOLD	SEPARATE
GUIDE	1.00			
LEAFLET	0.64	1.00		
KEEPCOLD	0.26	0.14	1.00	
SEPARATE	0.31	0.19	0.57	1.00

Appendix 33 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Reduction

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.TIME	2	0
L.LIFEST	3	0
L.TASTE	4	0
PURCHASE	0	0

LAMBDA-X

	brand	quality	price	inform	ppcon
LOYALTY	5	0	0	0	0
W.BRAND	6	0	0	0	0
GOV.LAB	0	7	0	0	0
PRIV.LAB	0	8	0	0	0
TRACEABI	0	9	0	0	0
PRI.RED	0	0	10	0	0
GUIDE	0	0	0	11	0
LEAFLET	0	0	0	12	0
KEEPCOLD	0	0	0	0	13
SEPARATE	0	0	0	0	14

Appendix 33 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Reduction (cont.)

BETA

	riskper	purchli
riskper	0	0
purchli	15	0

GAMMA

	brand	quality	price	inform	ppcon
riskper	16	17	18	19	20
purchli	0	0	0	0	0

PHI

	brand	quality	price	inform	ppcon
brand	0				
quality	21	0			
price	22	23	0		
inform	24	25	26	0	
ppcon	27	28	29	30	0

Appendix 33 Model Specification for Proposed Consumer Food Purchase Model Linking with Risk Reduction (cont.)

```
PSI
Note: This matrix is diagonal.

    riskper    purchli
   --------   --------
         31         32


THETA-EPS

   L.HEALTH    L.MONEY     L.TIME   L.LIFEST    L.TASTE   PURCHASE
   --------   --------   --------   --------   --------   --------
         33         34         35         36         37          0


THETA-DELTA

    LOYALTY    W.BRAND    GOV.LAB   PRIV.LAB   TRACEABI    PRI.RED
   --------   --------   --------   --------   --------   --------
         38         39         40         41         42          0


THETA-DELTA

      GUIDE    LEAFLET   KEEPCOLD   SEPARATE
   --------   --------   --------   --------
         43         44         45         46
```

Appendix 34 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Reduction

```
LISREL Estimates

        LAMBDA-Y

              riskper    purchli
              --------   --------
L.HEALTH        0.88        - -

 L.MONEY        0.89        - -
              (0.03)
               26.88

  L.TIME        0.92        - -
              (0.03)
               29.15

L.LIFEST        0.82        - -
              (0.04)
               22.63

 L.TASTE        0.69        - -
              (0.05)
               14.98

PURCHASE         - -       1.00
```

Appendix 34 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Reduction (cont.)

LISREL Estimates

LAMBDA-X

	brand	quality	price	inform	ppcon
LOYALTY	0.81 (0.04) 18.22	- -	- -	- -	- -
W.BRAND	0.85 (0.04) 19.46	- -	- -	- -	- -
GOV.LAB	- -	0.96 (0.03) 31.86	- -	- -	- -
PRIV.LAB	- -	0.75 (0.04) 19.69	- -	- -	- -
TRACEABI	- -	0.67 (0.05) 14.84	- -	- -	- -
PRI.RED	- -	- -	1.00 (0.04) 28.21	- -	- -

Appendix 34 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Reduction (cont.)

LISREL Estimates

LAMBDA-X

	brand	quality	price	inform	ppcon
GUIDE	- -	- -	- -	0.91 (0.04) 21.28	- -
LEAFLET	- -	- -	- -	0.75 (0.05) 16.74	- -
KEEPCOLD	- -	- -	- -	- -	0.72 (0.06) 12.02
SEPARATE	- -	- -	- -	- -	0.79 (0.06) 12.97

Appendix 34 Parameter Estimates for Proposed Consumer Food Purchase Model Linking with Risk Reduction (cont.)

```
         LISREL Estimates


                  BETA

                     riskper    purchli
                    --------   --------
           riskper     - -        - -

           purchli   -0.46        - -
                    (0.06)
                     -8.07


                  GAMMA

                       brand    quality      price     inform      ppcon
                    --------   --------   --------   --------   --------
           riskper     -0.34      -0.19       0.08      -0.25       0.18
                      (0.10)     (0.09)     (0.06)     (0.10)     (0.10)
                       -3.39      -2.11       1.29      -2.42       1.82

           purchli       - -        - -        - -        - -        - -
```

Appendix 35 Assessment of Discriminant Validity of Measurement Submodel

Factor	χ^2 (d.f.) Constrained model	Unconstrained model	χ^2 (d.f.=1) Difference
brand			
quality	63.70 (5)	12.28 (4)	51.42
price	98.31 (1)	-	98.31
inform	50.75 (2)	1.21 (1)	49.54
ppcon	39.70 (2)	0.47 (1)	39.23
riskper	222.52 (14)	32.00 (13)	190.52
purchli	77.91 (1)	-	77.91
quality			
price	98.71 (3)	0.64	98.07
inform	50.84 (5)	0.38 (4)	50.46
ppcon	71.23 (5)	3.10 (4)	68.13
riskper	275.27 (20)	35.48 (19)	239.79
purchli	87.47 (3)	0.93 (2)	86.54
price			
inform	112.55 (1)	-	112.55
ppcont	108.95 (1)	-	108.95
riskper	188.67 (10)	29.22 (9)	159.45
purchli	201.25 (1)	-	201.25
inform			
ppcon	49.44 (2)	0.17 (1)	49.27
riskper	242.12 (14)	34.36 (13)	207.76
purchli	78.32 (1)	-	78.32
ppcon			
riskper	143.51 (14)	32.24 (13)	111,27
purchli	101.37 (1)	-	101.37
riskper			
purchli	267.08 (10)	25.56 (9)	241.52

All χ^2 differences are significant (for 1 degree of freedom) at the 0.01 level.

Appendix 36 Assessment of Factor Validity

Factors	Average Variance Extracted
brand [brand]	0.69
quality assurance [quality]	0.64
price discount [price]	1.00
information [inform]	0.70
post purchase control [ppcon]	0.57
risk perception [riskper]	0.70
purchase likelihood [purchli]	1.00

Appendix 37 Model Specification for Consumer Food Purchase Rival Model Linking with Risk Reduction

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.TIME	2	0
L.LIFEST	3	0
L.TASTE	4	0
PURCHASE	0	0

LAMBDA-X

	brand	quality	price	inform	ppcon
LOYALTY	5	0	0	0	0
W.BRAND	6	0	0	0	0
GOV.LAB	0	7	0	0	0
PRIV.LAB	0	8	0	0	0
TRACEABI	0	9	0	0	0
PRI.RED	0	0	10	0	0
GUIDE	0	0	0	11	0
LEAFLET	0	0	0	12	0
KEEPCOLD	0	0	0	0	13
SEPARATE	0	0	0	0	14

Appendix 37 Model Specification for Consumer Food Purchase Rival Model Linking with Risk Reduction (cont.)

BETA

	riskper	purchli
riskper	0	0
purchli	15	0

GAMMA

	brand	quality	price	inform	ppcon
riskper	16	17	18	19	20
purchli	0	0	21	0	0

PHI

	brand	quality	price	inform	ppcon
brand	0				
quality	22	0			
price	23	24	0		
inform	25	26	27	0	
ppcon	28	29	30	31	0

Appendix 37 Model Specification for Consumer Food Purchase Rival Model Linking with Risk Reduction (cont.)

PSI
Note: This matrix is diagonal.

riskper	purchli
32	33

THETA-EPS

L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
34	35	36	37	38	0

THETA-DELTA

LOYALTY	W.BRAND	GOV.LAB	PRIV.LAB	TRACEABI	PRI.RED
39	40	41	42	43	0

THETA-DELTA

GUIDE	LEAFLET	KEEPCOLD	SEPARATE
44	45	46	47

Appendix 38 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Reduction

```
LISREL Estimates

         LAMBDA-Y

             riskper    purchli
            --------   --------
 L.HEALTH       0.88        - -

  L.MONEY       0.89        - -
              (0.03)
               26.75

   L.TIME       0.91        - -
              (0.03)
               29.05

 L.LIFEST       0.82        - -
              (0.04)
               22.47

  L.TASTE       0.69        - -
              (0.05)
               14.87

 PURCHASE        - -       1.00
```

Appendix 38 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Reduction (cont.)

```
LISREL Estimates

              LAMBDA-X

                 brand    quality      price     inform      ppcon
              --------   --------   --------   --------   --------
   LOYALTY        0.81        - -        - -        - -        - -
                (0.04)
                 18.15

   W.BRAND        0.84        - -        - -        - -        - -
                (0.04)
                 19.30

   GOV.LAB         - -       0.96        - -        - -        - -
                           (0.03)
                            31.35

  PRIV.LAB         - -       0.74        - -        - -        - -
                           (0.04)
                            19.29

  TRACEABI         - -       0.67        - -        - -        - -
                           (0.05)
                            14.61

   PRI.RED         - -        - -       1.00        - -        - -
                                      (0.04)
                                       28.39
```

Appendix 38 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Reduction (cont.)

LISREL Estimates

LAMBDA-X

	brand	quality	price	inform	ppcon
GUIDE	- -	- -	- -	0.92 (0.04) 20.96	- -
LEAFLET	- -	- -	- -	0.74 (0.05) 16.18	- -
KEEPCOLD	- -	- -	- -	- -	0.73 (0.06) 12.15
SEPARATE	- -	- -	- -	- -	0.79 (0.06) 12.98

Appendix 38 Parameter Estimates for Consumer Food Purchase Rival Model Linking with Risk Reduction (cont.)

```
LISREL Estimates

        BETA

              riskper    purchli
             --------   --------
  riskper       - -        - -

  purchli     -0.45        - -
             (0.06)
              -7.82

        GAMMA

               brand    quality      price     inform      ppcon
             --------   --------   --------   --------   --------
  riskper     -0.33      -0.19       0.00      -0.25       0.18
             (0.10)     (0.09)     (0.06)     (0.10)     (0.10)
              -3.39      -2.12       0.02      -2.39       1.77

  purchli       - -        - -      -0.24        - -        - -
                                   (0.06)
                                    -3.83
```

Appendix 39 Modification Index for Consumer Food Purchase Model Linking with Risk Reduction

Modification Indices for BETA

	riskper	purchli
riskper	- -	4.09[a]
purchli	- -	- -

Modification Indices for GAMMA

	brand	quality	price	inform	ppcon
riskper	- -	- -	- -	- -	- -
purchli	0.21	0.46	11.38[b]	1.38	0.07

[a] the path is against the existing theory
[b] same as the rival model

Appendix 40 Standardised Residuals for Consumer Food Purchase Model Linking with Risk Reduction

Standardized Residuals

	L.HEALTH	L.MONEY	L.TIME	L.LIFEST	L.TASTE	PURCHASE
L.HEALTH	- -					
L.MONEY	-5.23	- -				
L.TIME	-5.78	-5.24	- -			
L.LIFEST	-4.47	-6.08	-5.07	- -		
L.TASTE	-4.59	-5.10	-5.48	-2.41	- -	
PURCHASE	3.93	5.19	4.38	2.96	1.43	- -
LOYALTY	1.08	2.46	2.71	2.11	-0.13	-0.78
W.BRAND	1.32	3.52	4.53	2.69	0.92	0.07
GOV.LAB	2.53	3.91	2.86	0.71	1.97	-0.29
PRIV.LAB	2.12	2.76	3.31	1.01	2.81	-0.38
TRACEABI	1.66	2.10	2.59	1.49	1.72	0.51
PRI.RED	1.67	-0.71	-1.82	0.60	-1.26	-3.61
GUIDE	1.32	2.23	3.95	1.79	3.39	-0.08
LEAFLET	2.28	1.27	2.23	1.85	2.96	0.75
KEEPCOLD	-0.73	2.09	1.39	0.70	-0.62	-1.52
SEPARATE	-0.62	2.45	1.50	0.31	-0.90	-0.06

Appendix 40 Standardised Residuals for Consumer Food Purchase Model Linking with Risk Reduction (cont.)

Standardized Residuals

	LOYALTY	W.BRAND	GOV.LAB	PRIV.LAB	TRACEABI	PRI.RED
LOYALTY	- -					
W.BRAND	-3.82	- -				
GOV.LAB	-4.18	-2.09	- -			
PRIV.LAB	-2.84	-2.79	-4.11	- -		
TRACEABI	0.34	-1.04	-4.84	-1.13	- -	
PRI.RED	-0.79	-2.61	-2.96	-1.06	-1.93	- -
GUIDE	-2.94	-2.66	-3.09	-0.72	-0.92	-4.87
LEAFLET	-2.45	-0.98	-1.96	-1.02	-0.57	-1.02
KEEPCOLD	0.84	-0.54	-1.51	-1.01	0.90	1.14
SEPARATE	-0.28	-0.71	-1.93	-1.29	0.55	-1.50

Standardized Residuals

	GUIDE	LEAFLET	KEEPCOLD	SEPARATE
GUIDE	- -			
LEAFLET	-3.18	- -		
KEEPCOLD	-2.60	-3.13	- -	
SEPARATE	-2.29	-2.79	0.10	- -

Appendix 41 Model Specification of Model M1 for Consumer Food Purchase Linking with Risk Reduction

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.LIFEST	2	0
L.TASTE	3	0
PURCHASE	0	0

LAMBDA-X

	brand	quality	price	inform	selfcon
LOYALTY	4	0	0	0	0
W.BRAND	5	0	0	0	0
GOV.LAB	0	6	0	0	0
PRIV.LAB	0	7	0	0	0
TRACEABI	0	8	0	0	0
PRI.RED	0	0	9	0	0
GUIDE	0	0	0	10	0
LEAFLET	0	0	0	11	0
KEEPCOLD	0	0	0	0	12
SEPARATE	0	0	0	0	13

Appendix 41Model Specification of Model M1 for Consumer Food Purchase Linking with Risk Reduction (cont.)

BETA

	riskper	purchli
riskper	0	0
purchli	14	0

GAMMA

	brand	quality	price	inform	selfcon
riskper	15	16	17	18	19
purchli	0	0	0	0	0

PHI

	brand	quality	price	inform	selfcon
brand	0				
quality	20	0			
price	21	22	0		
inform	23	24	25	0	
selfcon	26	27	28	29	0

Appendix 41 Model Specification of Model M1 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
PSI
Note: This matrix is diagonal.

    riskper    purchli
   --------   --------
         30         31

THETA-EPS

   L.HEALTH    L.MONEY   L.LIFEST    L.TASTE   PURCHASE
   --------   --------   --------   --------   --------
         32         33         34         35          0

THETA-DELTA

    LOYALTY    W.BRAND    GOV.LAB   PRIV.LAB   TRACEABI    PRI.RED
   --------   --------   --------   --------   --------   --------
         36         37         38         39         40          0

THETA-DELTA

      GUIDE    LEAFLET   KEEPCOLD   SEPARATE
   --------   --------   --------   --------
         41         42         43         44
```

Appendix 42 Parameter Estimates of Model M1 for Consumer Food Purchase Linking with Risk Reduction

```
LISREL Estimates

        LAMBDA-Y

            riskper    purchli
           --------   --------
 L.HEALTH      0.89       - -

  L.MONEY      0.81       - -
             (0.05)
              17.69

 L.LIFEST      0.78       - -
             (0.04)
              18.03

  L.TASTE      0.68       - -
             (0.05)
              13.76

 PURCHASE       - -       1.00
```

Appendix 42 Parameter Estimates of Model M1 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
 LISREL Estimates

         LAMBDA-X

                brand    quality      price     inform      ppcon
             --------   --------   --------   --------   --------
  LOYALTY        0.79       - -        - -        - -        - -
               (0.05)
                17.53

  W.BRAND        0.84       - -        - -        - -        - -
               (0.04)
                18.99

  GOV.LAB        - -        0.93       - -        - -        - -
                          (0.03)
                           29.68

 PRIV.LAB        - -        0.75       - -        - -        - -
                          (0.04)
                           19.10

 TRACEABI        - -        0.67       - -        - -        - -
                          (0.05)
                           14.56

  PRI.RED        - -        - -        1.00       - -        - -
                                     (0.04)
                                      28.21
```

Appendix 42 Parameter Estimates of Model M1 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
 LISREL Estimates

         LAMBDA-X

                   brand    quality      price     inform      ppcon
                -------- --------   --------   --------   --------

       GUIDE        - -        - -        - -       0.91        - -
                                                  (0.04)
                                                   20.47

     LEAFLET        - -        - -        - -       0.74        - -
                                                  (0.05)
                                                   15.77

    KEEPCOLD        - -        - -        - -        - -       0.73
                                                             (0.06)
                                                              12.05

    SEPARATE        - -        - -        - -        - -       0.78
                                                             (0.06)
                                                              12.96
```

Appendix 42 Parameter Estimates of Model M1 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
LISREL Estimates

        BETA

                riskper    purchli
               --------   --------
  riskper          - -        - -

  purchli        -0.44        - -
                (0.06)
                 -7.23

        GAMMA

                  brand    quality      price     inform      ppcon
               --------   --------   --------   --------   --------
  riskper        -0.35      -0.19       0.09      -0.22       0.16
                (0.10)     (0.10)     (0.07)     (0.11)     (0.10)
                 -3.41      -1.94       1.37      -2.07       1.50

  purchli          - -        - -        - -        - -        - -
```

Appendix 43 Model Specification of Model M2 for Consumer Food Purchase Linking with Risk Reduction

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.TIME	1	0
L.LIFEST	2	0
L.TASTE	3	0
PURCHASE	0	0

LAMBDA-X

	brand	quality	price	inform	selfcon
LOYALTY	4	0	0	0	0
W.BRAND	5	0	0	0	0
GOV.LAB	0	6	0	0	0
PRIV.LAB	0	7	0	0	0
TRACEABI	0	8	0	0	0
PRI.RED	0	0	9	0	0
GUIDE	0	0	0	10	0
LEAFLET	0	0	0	11	0
KEEPCOLD	0	0	0	0	12
SEPARATE	0	0	0	0	13

Appendix 43 Model Specification of Model M2 for Consumer Food Purchase Linking with Risk Reduction (cont.)

BETA

	riskper	purchli
riskper	0	0
purchli	14	0

GAMMA

	brand	quality	price	inform	selfcon
riskper	15	16	17	18	19
purchli	0	0	0	0	0

PHI

	brand	quality	price	inform	selfcon
brand	0				
quality	20	0			
price	21	22	0		
inform	23	24	25	0	
selfcon	26	27	28	29	0

Appendix 43 Model Specification of Model M2 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
PSI
Note: This matrix is diagonal.

    riskper    purchli
   --------   --------
         30         31

THETA-EPS

   L.HEALTH     L.TIME   L.LIFEST    L.TASTE   PURCHASE
   --------   --------   --------   --------   --------
         32         33         34         35          0

THETA-DELTA

    LOYALTY    W.BRAND    GOV.LAB   PRIV.LAB   TRACEABI    PRI.RED
   --------   --------   --------   --------   --------   --------
         36         37         38         39         40          0

THETA-DELTA

      GUIDE    LEAFLET   KEEPCOLD   SEPARATE
   --------   --------   --------   --------
         41         42         43         44
```

Appendix 44 Parameter Estimates of Model M2 for Consumer Food Purchase Linking with Risk Reduction

```
LISREL Estimates

        LAMBDA-Y

               riskper    purchli
              --------   --------
 L.HEALTH        0.86        - -

   L.TIME        0.85        - -
               (0.04)
                19.38

 L.LIFEST        0.81        - -
               (0.04)
                20.01

  L.TASTE        0.66        - -
               (0.05)
                13.08

 PURCHASE         - -       1.00
```

Appendix 44 Parameter Estimates of Model M2 for Consumer Food Purchase Linking with Risk Reduction (cont.)

LISREL Estimates

LAMBDA-X

	brand	quality	price	inform	ppcon
LOYALTY	0.80 (0.05) 17.71	- -	- -	- -	- -
W.BRAND	0.85 (0.04) 18.98	- -	- -	- -	- -
GOV.LAB	- -	0.95 (0.03) 30.87	- -	- -	- -
PRIV.LAB	- -	0.75 (0.04) 19.38	- -	- -	- -
TRACEABI	- -	0.67 (0.05) 14.51	- -	- -	- -
PRI.RED	- -	- -	1.00 (0.04) 28.21	- -	- -

Appendix 44 Parameter Estimates of Model M2 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
LISREL Estimates

            LAMBDA-X

               brand    quality      price     inform      ppcon
            --------   --------   --------   --------   --------

    GUIDE       - -        - -        - -       0.92        - -
                                               (0.05)
                                                19.41

  LEAFLET       - -        - -        - -       0.75        - -
                                               (0.05)
                                                15.36

 KEEPCOLD       - -        - -        - -        - -       0.73
                                                          (0.06)
                                                           11.38

 SEPARATE       - -        - -        - -        - -       0.80
                                                          (0.07)
                                                           12.23
```

Appendix 44 Parameter Estimates of Model M2 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
 LISREL Estimates

         BETA

             riskper    purchli
            --------   --------
  riskper       - -        - -

  purchli     -0.47        - -
             (0.06)
              -7.70

         GAMMA

               brand    quality      price     inform      ppcon
            --------   --------   --------   --------   --------
  riskper     -0.32      -0.23       0.09      -0.17       0.10
             (0.10)     (0.09)     (0.07)     (0.10)     (0.10)
              -3.16      -2.42       1.39      -1.78       1.02

  purchli       - -        - -        - -        - -        - -
```

Appendix 45 Model Specification of Model M3 for Consumer Food Purchase Linking with Risk Reduction

LAMBDA-Y

	riskper	purchli
L.HEALTH	0	0
L.MONEY	1	0
L.TIME	2	0
L.LIFEST	3	0
L.TASTE	4	0
PURCHASE	0	0

LAMBDA-X

	brand	quality	price	inform	selfcon
LOYALTY	5	0	0	0	0
W.BRAND	6	0	0	0	0
GOV.LAB	0	7	0	0	0
PRIV.LAB	0	8	0	0	0
TRACEABI	0	9	0	0	0
PRI.RED	0	0	10	0	0
LEAFLET	0	0	0	11	0
KEEPCOLD	0	0	0	0	12
SEPARATE	0	0	0	0	13

Appendix 45 Model Specification of Model M3 for Consumer Food Purchase Linking with Risk Reduction (cont.)

BETA

	riskper	purchli
riskper	0	0
purchli	14	0

GAMMA

	brand	quality	price	inform	selfcon
riskper	15	16	17	18	19
purchli	0	0	0	0	0

PHI

	brand	quality	price	inform	selfcon
brand	0				
quality	20	0			
price	21	22	0		
inform	23	24	25	0	
selfcon	26	27	28	29	0

Appendix 45 Model Specification of Model M3 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
         PSI
         Note: This matrix is diagonal.

            riskper    purchli
           --------   --------
                 30         31

         THETA-EPS

           L.HEALTH    L.MONEY     L.TIME   L.LIFEST    L.TASTE   PURCHASE
           --------   --------   --------   --------   --------   --------
                 32         33         34         35         36          0

         THETA-DELTA

            LOYALTY    W.BRAND    GOV.LAB   PRIV.LAB   TRACEABI    PRI.RED
           --------   --------   --------   --------   --------   --------
                 37         38         39         40         41          0

         THETA-DELTA

            LEAFLET   KEEPCOLD   SEPARATE
           --------   --------   --------
                  0         42         43
```

Appendix 46 Parameter Estimates of Model M3 for Consumer Food Purchase Linking with Risk Reduction

```
LISREL Estimates

         LAMBDA-Y

              riskper    purchli
              --------   --------
 L.HEALTH       0.87        - -

  L.MONEY       0.89        - -
              (0.03)
               26.08

   L.TIME       0.91        - -
              (0.03)
               28.54

 L.LIFEST       0.82        - -
              (0.04)
               22.10

  L.TASTE       0.68        - -
              (0.05)
               14.63

 PURCHASE        - -       1.00
```

Appendix 46 Parameter Estimates of Model M3 for Consumer Food Purchase Linking with Risk Reduction (cont.)

LISREL Estimates

LAMBDA-X

	brand	quality	price	inform	ppcon
LOYALTY	0.80 (0.05) 17.70	- -	- -	- -	- -
W.BRAND	0.85 (0.04) 19.19	- -	- -	- -	- -
GOV.LAB	- -	0.95 (0.03) 30.66	- -	- -	- -
PRIV.LAB	- -	0.75 (0.04) 19.24	- -	- -	- -
TRACEABI	- -	0.67 (0.05) 14.66	- -	- -	- -

Appendix 46 Parameter Estimates of Model M3 for Consumer Food Purchase Linking with Risk Reduction (cont.)

LISREL Estimates

LAMBDA-X

	brand	quality	price	inform	ppcon
PRI.RED	- -	- -	1.00 (0.04) 28.21	- -	- -
LEAFLET	- -	- -	- -	1.00 (0.04) 28.21	- -
KEEPCOLD	- -	- -	- -	- -	0.72 (0.07) 10.50
SEPARATE	- -	- -	- -	- -	0.78 (0.07) 11.16

Appendix 46 Parameter Estimates of Model M3 for Consumer Food Purchase Linking with Risk Reduction (cont.)

```
 LISREL Estimates


        BETA

               riskper    purchli
              --------   --------
  riskper         - -        - -

  purchli       -0.46        - -
               (0.06)
                -7.90


        GAMMA

                 brand    quality      price     inform      ppcon
              --------   --------   --------   --------   --------
  riskper       -0.34      -0.25       0.09      -0.14       0.12
               (0.10)     (0.09)     (0.07)     (0.08)     (0.09)
                -3.49      -2.92       1.34      -1.79       1.35

  purchli         - -        - -        - -        - -        -
```

Appendix 47 Sample of Questionnaire

PhD Research Project: Food Safety issues – Fresh Chicken Meat

Survey Question:

1. Do you eat chicken meat product? Yes ☐ No ☐

If yes, please complete the following questionnaire and ensure that you read each question carefully.

Note: There is no "right" or "wrong" answer for the question but it is purely asking about your own opinions as a member of public.

Definitions:

Microbiological Hazards refer to hazards caused by bacteria, such as Salmonella or E. Coli and so forth.

Section A: Food Risk Characteristics

How far do you agree with the following statements?

Please circle the answer on a scale of 1 to 7, where 1 = strongly disagree, 7 = strongly agree and 4 = Neutral / Don't Know (N).

	Strongly Disagree			N			Strongly Agree	
1. The main source of food contamination is								
a. in the farm.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C1)
b. at the abattoir / slaughter house.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C3)
b. due to improper handling with food retailer.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C5)
c. due to improper storage at home.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C7)
b. due to poor food handling at home.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C9)
c. due to improper cooking procedure.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C11)
2. I have knowledge of microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C13)
3. I am aware of the impact of microbiological hazards to my health.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C15)
4. I am concerned about the consequence of eating chicken meat that has microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C17)
5. I do not have complete information about microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C19)
6. I am concerned about microbiological hazards when I buy chicken meat products.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C21)

	Strongly Disagree			N			Strongly Agree	
7. The media exaggerates the consequence of microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C23)
8. Scientists know the consequence of microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C25)
9. I can prevent microbiological hazards by observing producer's cooking instructions.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C27)
10. Thorough cooking can reduce microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C29)
11. Microbiological hazards can be controlled by regulations.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C31)
12. There are enough regulations in controlling microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C33)
13.There is enough enforcement of regulations on microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C35)
14. Microbiological hazards are top on government's agenda.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C37)
15. Activists can exert influences to reduce microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C39)
16. Food producers can prevent microbiological hazards.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C41)
17. I can choose not to buy chicken meat with Salmonella.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C43)
18. Microbiological hazards can cause death.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C45)
19. Microbiological hazards is harmful to health.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C47)
20. The real risks of microbiological hazards are hidden from consumers.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C49)
21. Microbiological hazards will have adverse effect on future generation.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C51)
22. Microbiological hazards will have adverse effect on the environment.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C53)
23. The effects of microbiological hazards are widespread across U K.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C55)
24. The adverse effects of microbiological hazards such as food poisoning can spread quickly.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C55)
25. The adverse effects of microbiological hazards cannot be controlled/terminated easily.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	(C57)
26. The adverse effects of microbiological hazards cannot be controlled/terminated quickly.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**(C59)**

	Strongly Disagree			N			Strongly Agree	
27. Microbiological hazards are becoming more serious.	1	2	3	4	5	6	7	(C61)
28. People in general are at risk from microbiological hazards.	1	2	3	4	5	6	7	(C63)

Section B: Consequent Loss

What is the likelihood of occurrence of the following consequent loss when you eat chicken meat product? How serious is the loss to you if it did occur?

Please circle the answer of ***both sides*** *on a scale of 1 to 7, where 4 = Neutral / Don't know (N); on left-hand side 1 = very unlikely, and 7 = very likely that the consequent loss could occur; and on right-hand side 1 = not at all, and 7 = very much that there could be serious loss.*

Occurrence (Very Unlikely 1 – N – Very Likely 7)		Serious loss (not at all 1 – N – Very Much 7)
1 2 3 4 5 6 7 (C65)	29. I could be sick.	1 2 3 4 5 6 7 (C67)
1 2 3 4 5 6 7 (C69)	30. My health could be adversely affected.	1 2 3 4 5 6 7 (C71)
1 2 3 4 5 6 7 (C73)	31. My health could be adversely affected for long term.	1 2 3 4 5 6 7 (C75)
1 2 3 4 5 6 7 (C77)	32. My money could be wasted. (e.g. disposal of food, payment for medicine)	1 2 3 4 5 6 7 (C79)
1 2 3 4 5 6 7 (C81)	33. I could lose income / job due to poor health because of contaminated chicken meat.	1 2 3 4 5 6 7 (C83)
1 2 3 4 5 6 7 (C85)	34. My time could be lost. (e.g.. sickness, seeking compensation)	1 2 3 4 5 6 7 (C87)
1 2 3 4 5 6 7 (C89)	35. I could be let down or embarrassed among friends / family due to the contaminated chicken meat I have bought.	1 2 3 4 5 6 7 (C91)
1 2 3 4 5 6 7 (C93)	36. I could feel upset or personally dissatisfied due to the contaminated chicken meat I have bought.	1 2 3 4 5 6 7 (C95)
1 2 3 4 5 6 7 (C97)	37. My lifestyle could be adversely affected.	1 2 3 4 5 6 7 (C99)
1 2 3 4 5 6 7 (C101)	38. The taste of chicken could be adversely affected.	1 2 3 4 5 6 7 (C103)

Section C: Risk Reduction

Please circle the answer on a scale of 1 to 7, where 1 = very unlikely (VU), 7 = very likely (VL) and 4 = Neutral / Don't Know (N).

39. I will choose the following methods to ensure that the fresh chicken meat product is safe to purchase?

	Very Unlikely			N			Very Likely	
a. Purchasing the same brand /store that you purchased before.	1	2	3	4	5	6	7	(C105)
b. Choosing a well-known or popular brand	1	2	3	4	5	6	7	(C107)
c. Ensuring they have some form of money back guarantee	1	2	3	4	5	6	7	(C109)
d. Choosing those with quality assurance	1	2	3	4	5	6	7	(C111)
e. Purchasing meat that has been tested by government laboratory	1	2	3	4	5	6	7	(C113)
f. Purchasing meat that has been tested by private laboratory	1	2	3	4	5	6	7	(C115)
g. Ensuring the meat has been traced to the original producer	1	2	3	4	5	6	7	(C117)
h. Purchasing the product with price reduction	1	2	3	4	5	6	7	(C119)
i. Purchasing free range chicken	1	2	3	4	5	6	7	(C121)
j. Shopping around to compare what is on offer	1	2	3	4	5	6	7	(C123)
k. Purchasing meat product that is available in all major supermarkets	1	2	3	4	5	6	7	(C125)
l. Taking the advice of family and friends	1	2	3	4	5	6	7	(C127)
m. Reading consumer guides for food storage and cooking instruction	1	2	3	4	5	6	7	(C129)
n. Reading in-store leaflet for product information	1	2	3	4	5	6	7	(C131)
o. Inspecting the meat product before purchase	1	2	3	4	5	6	7	(C133)
p. Keeping the meat in fridge / freeze after purchase	1	2	3	4	5	6	7	(C135)
q. Separating the chicken meat product from other products	1	2	3	4	5	6	7	(C137)

Section D: Purchase Likelihood

Please circle the answer on a scale of 1 to 7, where 1 = very unlikely (VU), 7 = very likely (VL) and 4 = Neutral / Don't Know (N).

40. If there is evidence of microbiological risk in chicken meat, what is your response?

	Very Unlikely			N			Very Likely	
a. I will continue to purchase.	1	2	3	4	5	6	7	(C139)
b. I will purchase fresh chicken meat again after 1 month.	1	2	3	4	5	6	7	(C141)
c. I will purchase fresh chicken meat again after 3 months.	1	2	3	4	5	6	7	(C143)
d. I will purchase fresh chicken meat again after 6 months.	1	2	3	4	5	6	7	(C145)
e. I will buy chicken meat when evidence proved clear of the risk.	1	2	3	4	5	6	7	(C147)

41. Any other suggestion for lessening the food risk / improving the food safety:

____

____

Section E: Personal Data

Please indicate the appropriate box by a tick for the following items.

Gender: Male ☐ Female ☐ (C179)

Age Range: 16-24 ☐ 25-34 ☐ 35-44 ☐
45-54 ☐ 55-64 ☐ Over 65 ☐ (C181)

Marital Status: Single ☐ Married ☐ Others ☐ (C183)

Education Background:

A Level ☐ HND/Degree ☐ Higher Degree ☐
Professional Qualification ☐ Others ☐ (C185)

Employment Status:

F/T Employed ☐ P/T Employed ☐ Self Employed ☐
Unemployed ☐ Student ☐ Others ☐ (C187)

Occupation: ____

Total Household Income:

Below £15,000 p.a. ☐ £15,000-19,999 p.a. ☐ £20,000-29,999 p.a. ☐
£30,000-49,999 p.a. ☐ £50,000 or over p.a. ☐ (C189)

Thank you for completing this questionnaire!

Cranfield UNIVERSITY Silsoe

Appendix 48 Samples of Qualitative Interview Records